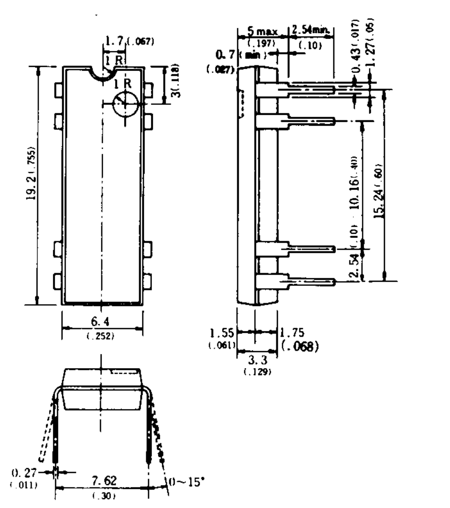
MN3008

2048-STAGE LOW NOISE BBD

■ General description

The MN3008 is a 2048-stage long delay low noise BBD that provides a signal delay of up to 102.4msec.

The MN3008 is particularly suitable for use as reverberation effect in electronic musical instruments such as stereo equipment due to its long delay time.



Special 8-Lead Dual-In-Line Plastic Package

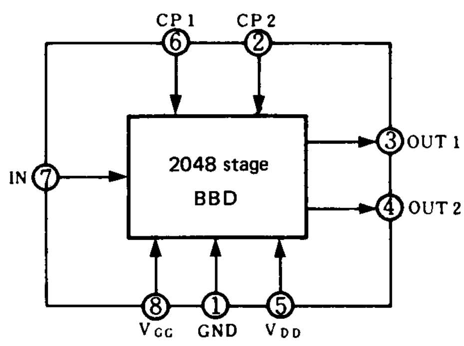
■ Features

- Variable delay time of audio signal: 10.24 ~ 102.4ms.
- Clock component cancellation capability.
- No insertion loss: L_i = 0dB typ.
- Wide dynamic range: S/N = 78dB typ.
- Wide frequency response: $f_i \leqq 10$KHz.
- Low distortion: THD = 0.5% typ. (V_i = 0.78Vrms).
- Clock frequency range: 10 ~ 100KHz.
- P channel silicon gate process.
- Special 8-Lead Dual-In-Line Plastic Package.

■ Applications

- Reverberation effect of echo microphone and stereo equipments.
- Chorus effects in electronic musical instruments.
- Variable or fixed delay of analog signals.
- Telephone time compression and delay line for voice communication systems, etc.

■ Block Diagram



■ Quick Reference Data

Item	Symbol	Value	Unit
Supply Voltage	V_{DD}, V_{GG}	−15, V_{DD}+1	V
Signal Delay Time	t_D	10.24~102.4	ms
Total Harmonic Distortion	THD	0.5	%
Signal to Noise Ratio	S/N	78	dB

■ Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Terminal Voltage	V_{DD}, V_{GG}, V_{CP}, V_I	−18∼+0.3	V
Output Voltage	V_O	−18∼+0.3	V
Operating Temperature	Topr	−20∼+60	℃
Storage Temperature	Tstg	−55∼+125	℃

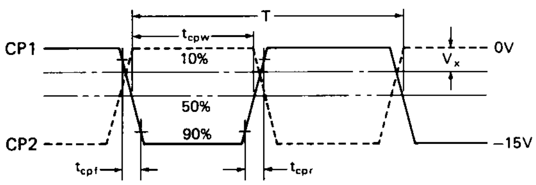
■ Operating Conditions (Ta = 25°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Drain Supply Voltage	V_{DD}		−14	−15	−16	V
Gate Supply Voltage	V_{GG}			$V_{DD}+1$		V
Clock Voltage "H" Level	V_{CPH}		0		−1	V
Clock Voltage "L" Level	V_{CPL}			V_{DD}		V
Clock Input Capacitance	C_{CP}				1400	pF
Clock Frequency	f_{CP}		10		100	kHz
Clock Pulse Width *1	t_{cpw}				0.5T*2	
Clock Rise Time *1	t_{cpr}				500	ns
Clock Fall Time *1	t_{cpf}				500	ns
Clock Cross Point *1	V_X		0		−3	V
Input DC Bias	V_{Bias}		−5		−10	V

■ Electrical Characteristics (Ta = 25°C, V_{DD} = V_{CPL} = −15V, V_{CPH} = 0V, V_{GG} = −14V, R_L = 100kΩ)

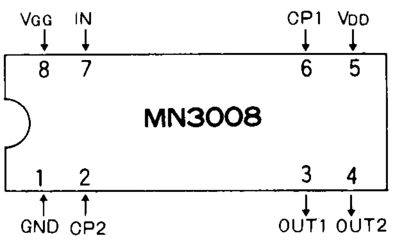
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Signal Delay Time	t_D		10.24		102.4	ms
Input Signal Frequency	f_i	f_{cp} = 40kHz, V_i = 1.7Vrms 3dB down (0dB at f_i = 1kHz)	10			kHz
Input Signal Swing	V_i	f_{CP}=40kHz, f_i = 1 kHz, THD = 2.5%	1.2			Vrms
Insertion Loss	L_i	f_{CP}=40kHz, f_i = 1 kHz, V_i = 1.2Vrms	−4	0	+4	dB
Total Harmonic Distortion	THD	f_{CP}=40kHz, f_i = 1 kHz, V_i = 0.78Vrms		0.5	2.5	%
Noise	V_{no}	f_{cp} = 100kHz, weighted by "A" curve			0.4	mVrms
Signal to Noise Ratio	S/N			78		dB

*1 Clock Pulse Waveforms



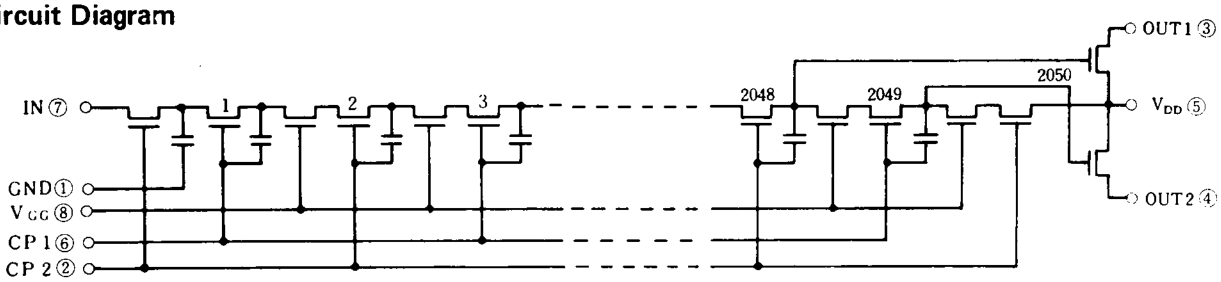
*2 T = 1/f_{CP} (Clock period)

■ Terminal Assignments



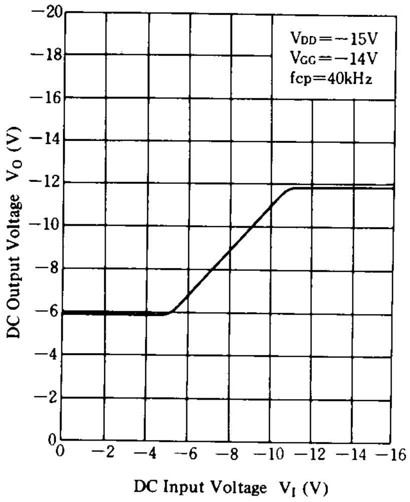
(Top View)

■ Circuit Diagram

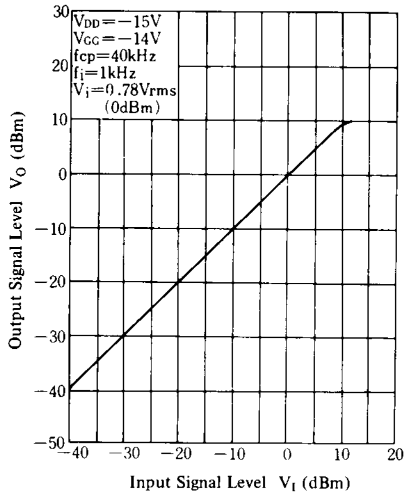


■ Typical Electrical Characteristic Curves

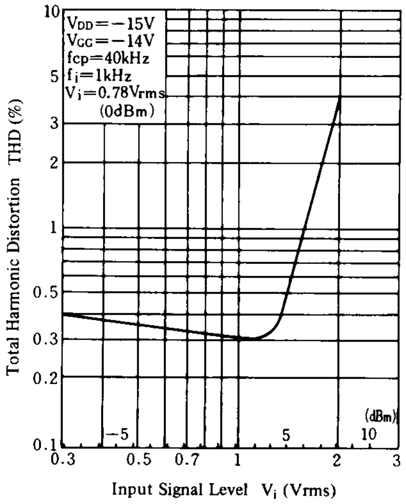
Vo—VI



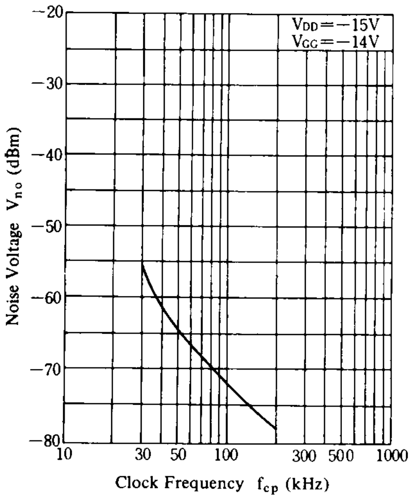
Vo—Vi



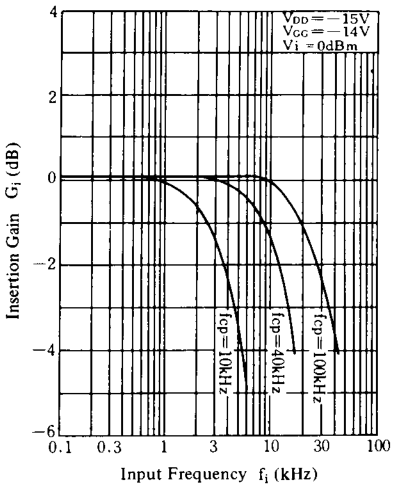
THD—Vi



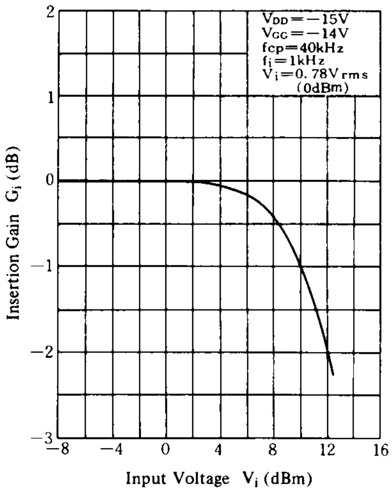
Vno—fcp



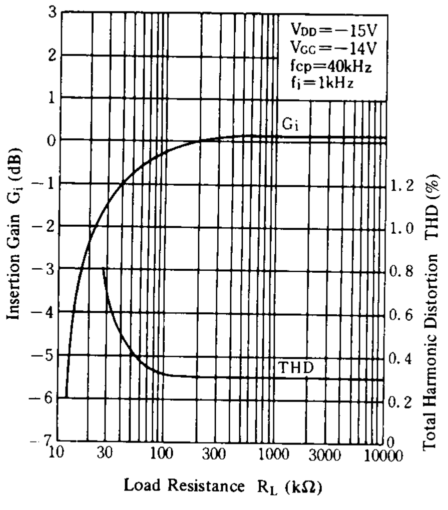
Gi—fi



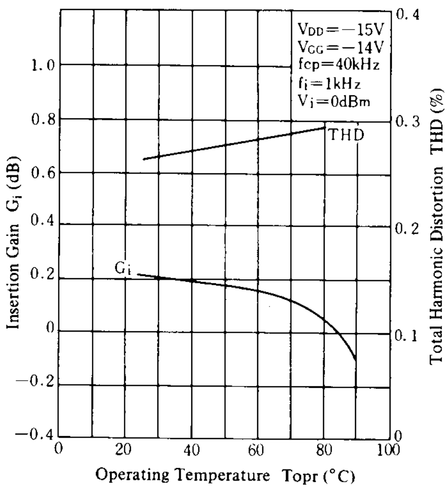
Gi—Vi



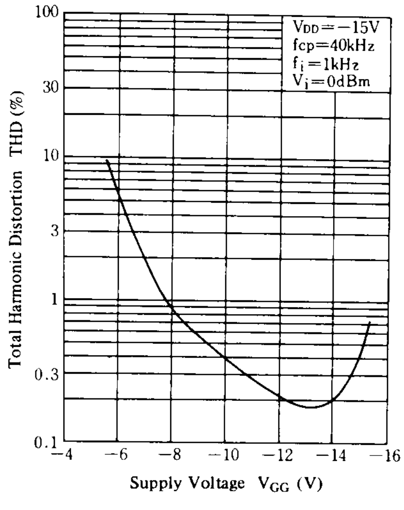
Gi, THD—RL



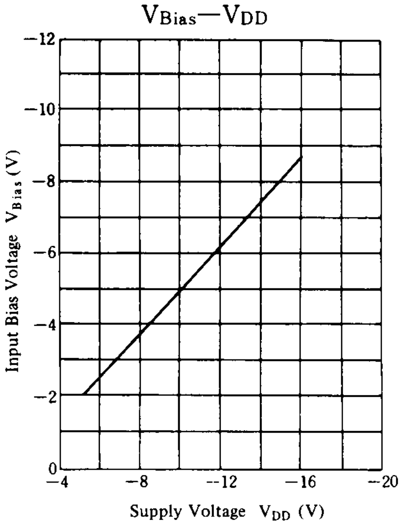
Gi, THD—Topr

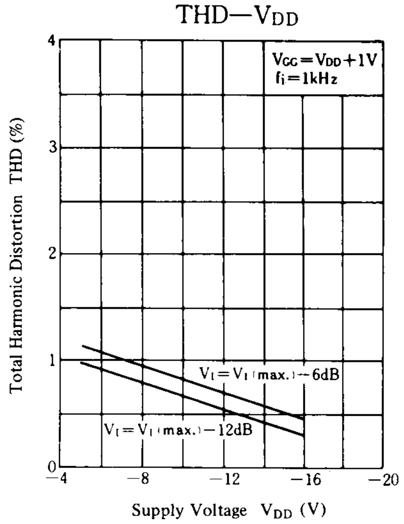


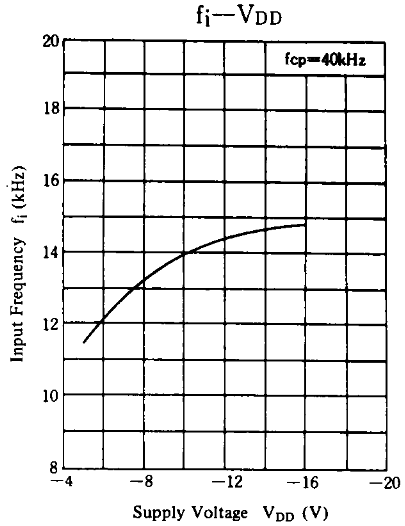
THD—VGG

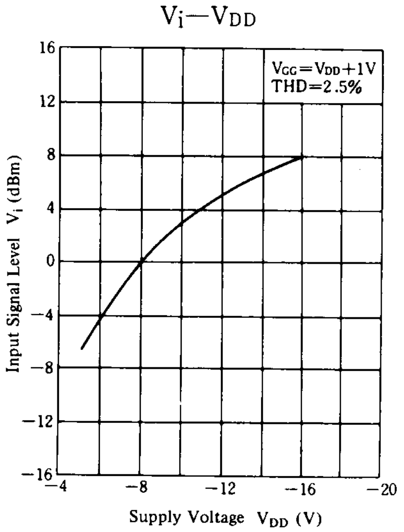


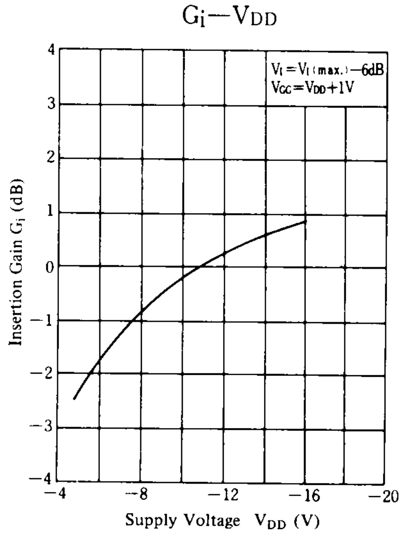
Supply Voltage Characteristics

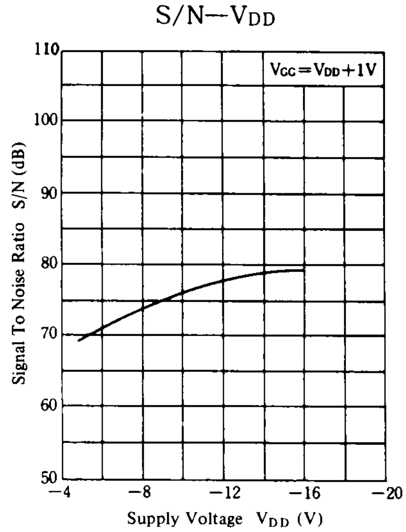




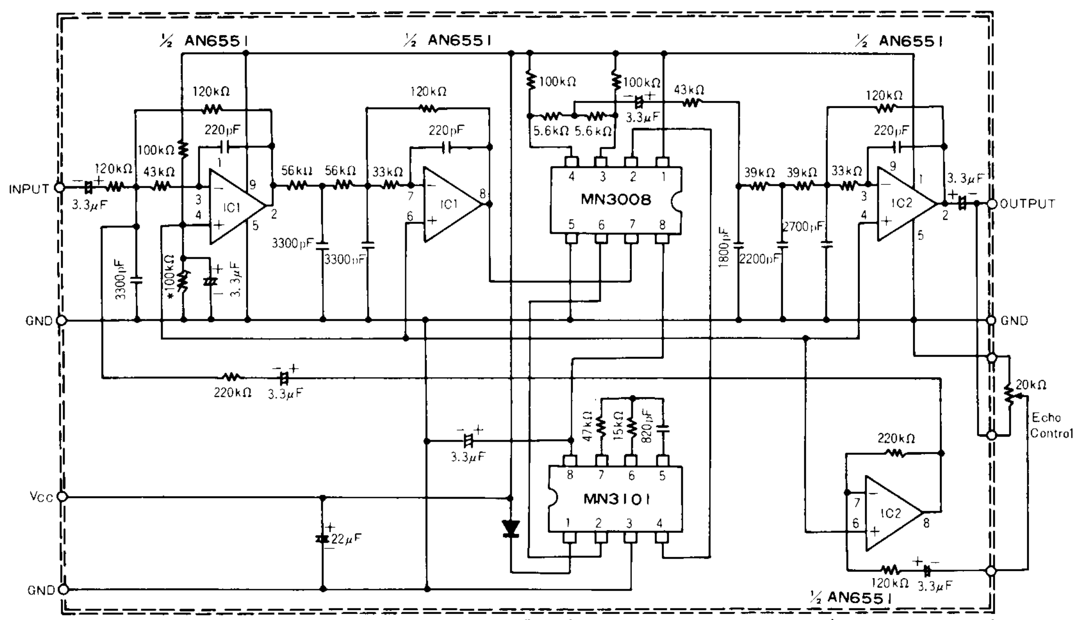








Application Circuit



* Adjust to minimize distortion (VR 100KΩ typ.)

Reverberation Effect Generation Circuit (Signal Delay Over 100msec.)

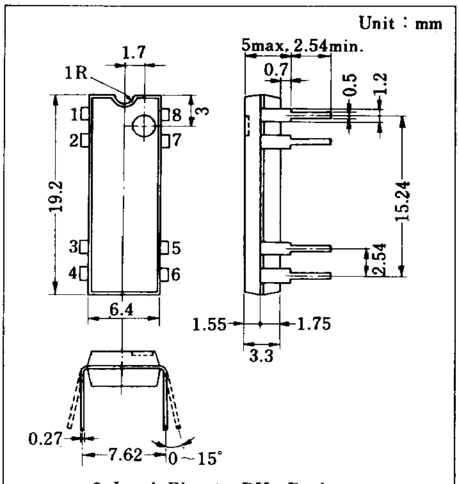
MN3008

2048段アナログ信号遅延用ローノイズBBD
2048-Stage Low Noise BBD for Analog Signal Delays

■ 概　要／Description

MN3008は，遅延段数2048段を有するロングディレイ ローノイズBBDで，最大遅延時間102.4 msが得られます。
遅延時間が長いので，ステレオなどの音響装置の残響効果を出すのに最適です。

The MN3008 is a 2048-stage low noise BBD variable delay line in audio frequency range. The device provides a signal delay up to 102.4 ms.



8-Lead Plastic DIL Package

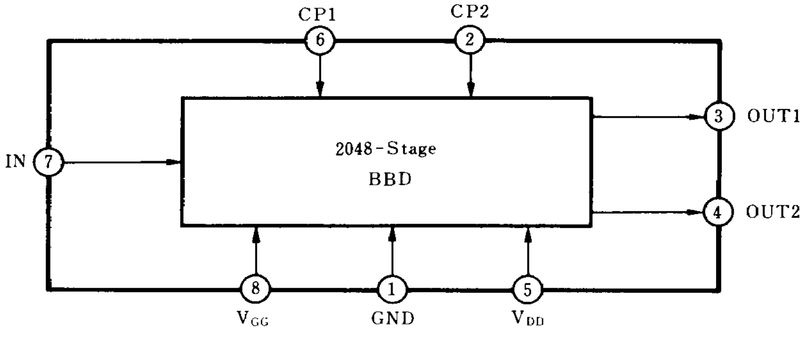
■ 特　徴

- オーディオ信号の可変遅延：10.24 ms～102.4 ms
- クロック成分の除去が可能
- 挿入損失がない：L_i=0 dB typ.
- ダイナミックレンジが広い：S/N=78 dB typ.
- 周波数レスポンスが広い：f_i≦10 kHz
- 低歪率：THD=0.5 % typ.（V_i=0.78 Vrms）
- クロック周波数範囲：10 kHz～100 kHz
- Pチャンネル・シリコンゲートプロセス
- 8ピン・プラスチックDILパッケージ

■ 用　途

- エコーマイク，ステレオなど音響装置の残響効果，反響効果
- 電子楽器の音響効果
- アナログ信号の可変または固定式遅延回路

■ ブロック図／Block Diagram



■ 絶対最大定格／Absolute Maximum Ratings (Ta＝25℃)

Item	Symbol	Rating	Unit
端子電圧	V_{DD}, V_{GG}, V_{CP}, V_I	−18〜+0.3	V
出力電圧	V_o	−18〜+0.3	V
動作周囲温度	T_{opr}	−20〜+60	℃
保存温度	T_{stg}	−55〜+125	℃

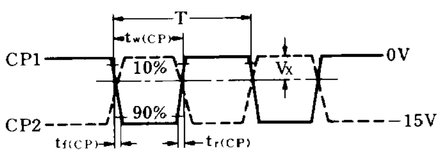
■ 動作条件／Operating Conditions (Ta＝25℃)

Item	Symbol	Condition	min.	typ.	max.	Unit
電源電圧	V_{DD}		−14	−15	−16	V
電源電圧	V_{GG}			V_{DD}+1		V
クロック電圧ハイレベル	V_{CPH}		0		−1	V
クロック電圧ローレベル	V_{CPL}			V_{DD}		V
クロック周波数	f_{CP}		10		100	kHz
パルス幅 (Clock Pulse)	$t_{w(CP)}$		0.4T		0.5T*1	
立上り時間 (Clock Pulse)	$t_{r(CP)}$				500*2	ns
立下り時間 (Clock Pulse)	$t_{f(CP)}$				500*2	ns
クロック・クロスポイント	V_x		0		−3	V
クロック入力容量	C_{CP}				1400	pF
入力バイアス電圧 (DC)	V_{Bias}		−5		−10	V

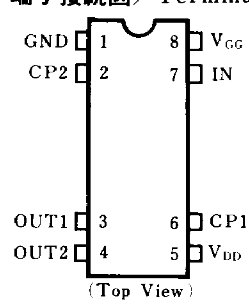
■ 電気的特性／Electrical Characteristics (Ta=25℃, V_{DD}=V_{CPL}=−15V, V_{CPH}=0V, V_{GG}=−14V, R_L=100kΩ)

Item	Symbol	Condition	min.	typ.	max.	Unit
入力周波数	f_i	f_{CP}=40kHz, V_i=1.2Vrms 出力減衰値≦3dB (0dB at f_i=1kHz)			10	kHz
入力電圧振幅	v_i	f_{CP}=40kHz, f_i=1kHz, THD=2.5%			1.2	Vrms
挿入損失	L_i	f_{CP}=40kHz, f_i=1kHz, V_i=1.2Vrms	−4	0	4	dB
全高調波歪率	THD	f_{CP}=40kHz, f_i=1kHz, V_i=0.78Vrms		0.5	2.5	%
出力雑音電圧	V_{no}	f_{CP}=100kHz, Aカーブ聴感補正			0.4	mVrms
信号対雑音比	S/N	f_{CP}=100kHz, Aカーブ聴感補正		78		dB

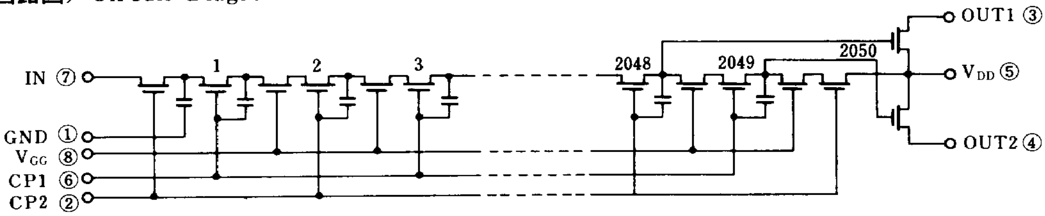
*1　T＝1/f_{CP} (クロック周期)
*2　クロックパルス波形



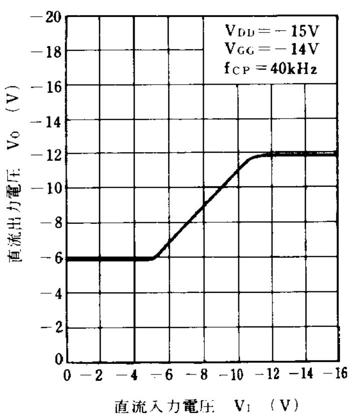
■ 端子接続図／Terminal Connections



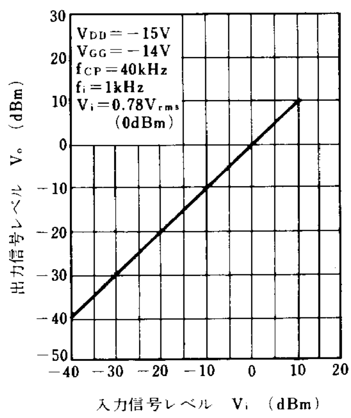
■ 回路図／Circuit Diagram



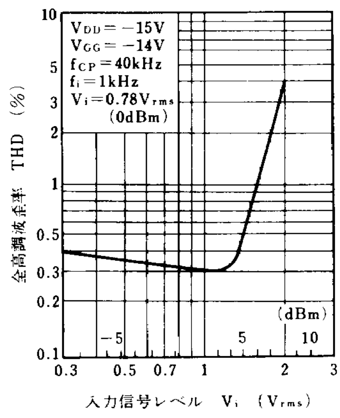
$V_O - V_I$



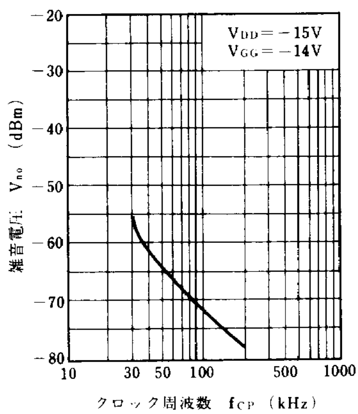
$V_o - V_i$



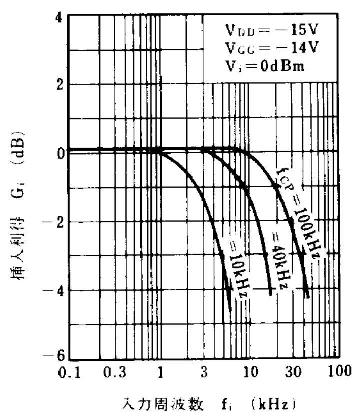
$THD - V_i$



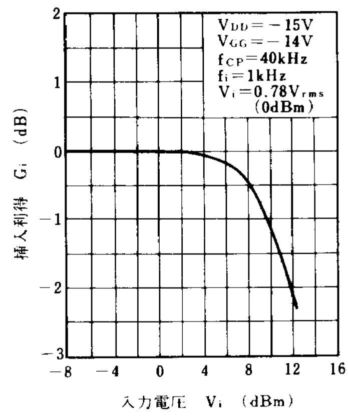
$V_{no} - f_{CP}$



$G_i - f_i$

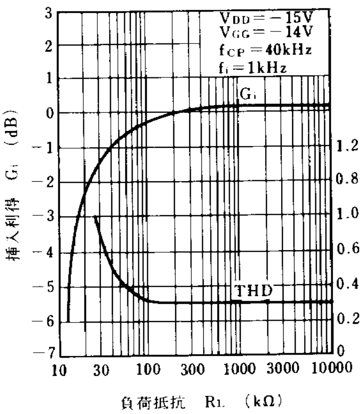


$G_i - V_i$

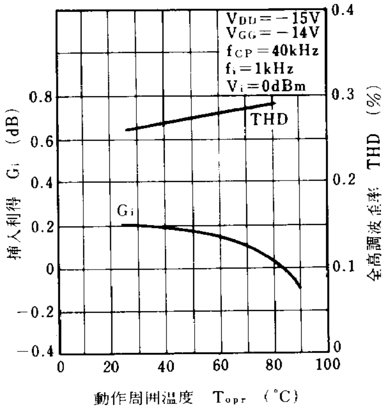


Panasonic

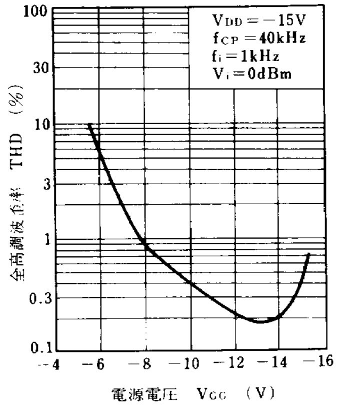
G_i, THD − R_L



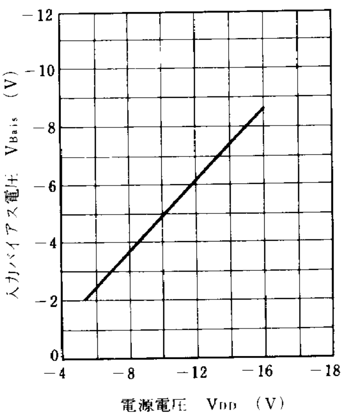
G_i, THD − T_{opr}



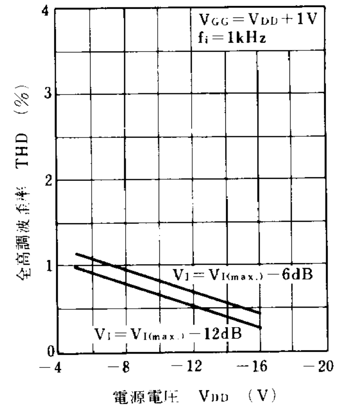
THD − V_{GG}



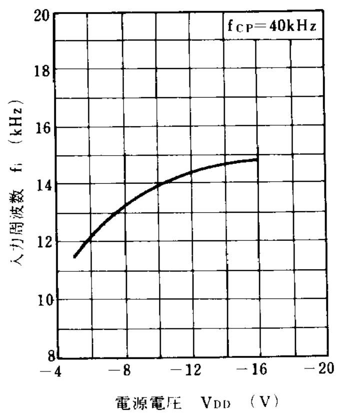
V_{Bias} − V_{DD}



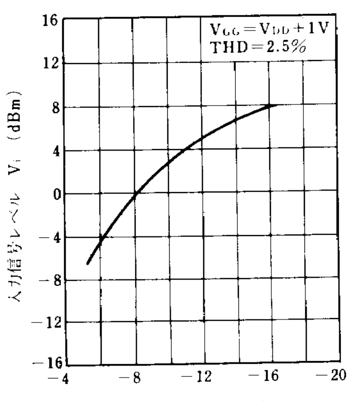
THD − V_{DD}



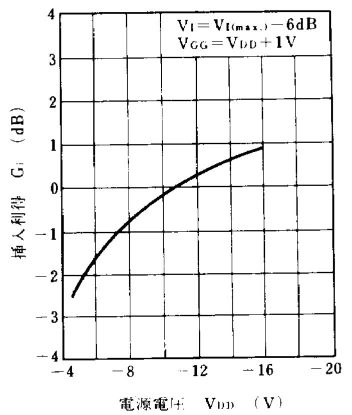
f_i − V_{DD}



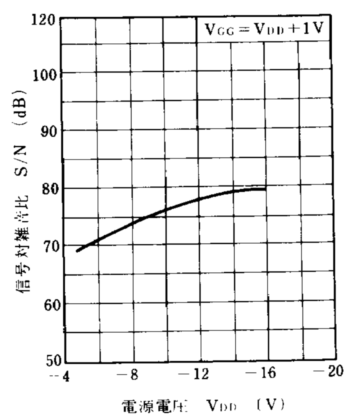
V_i − V_{DD}



G_i − V_{DD}

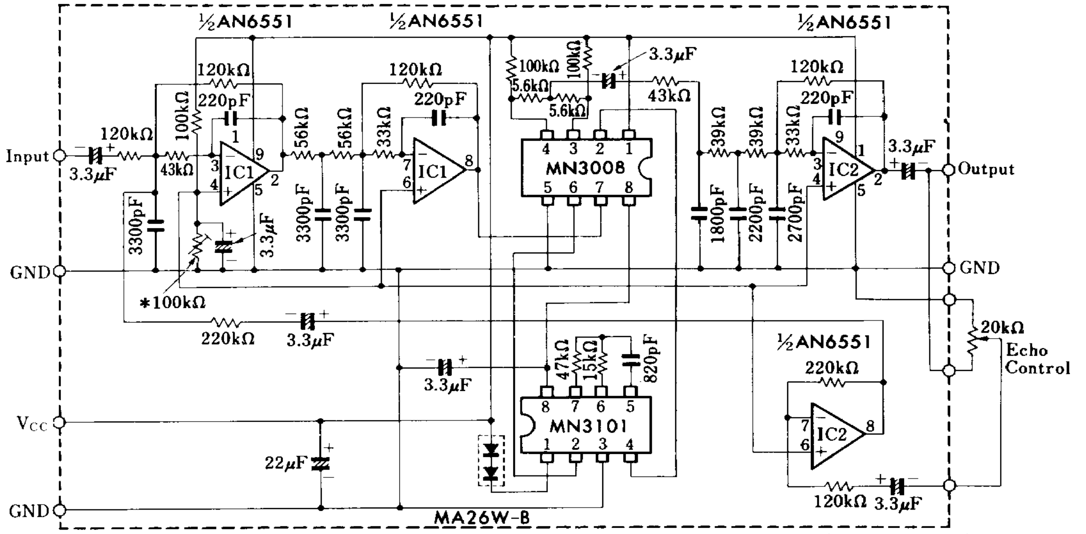


S/N − V_{DD}



■ 応用回路例／Application Circuit

残響効果発生回路（約 100 ms 以上の信号遅延）／Reverberation Effect Generation Circuit (Signal Delay Over 100ms)



* 歪が最小になるように調整(VR 100kΩ typ.)

MN3101

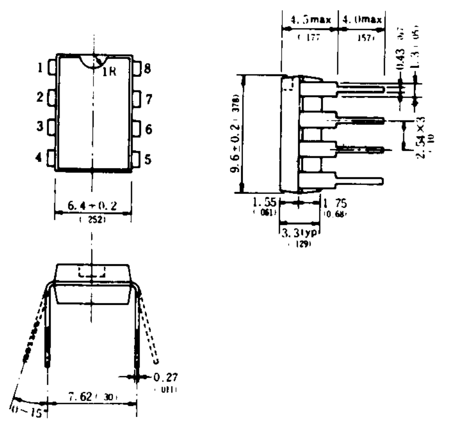
CLOCK GENERATOR/DRIVER CMOS LSI FOR BBD

■ Description

The MN3101 is a CMOS LSI generating two phase clock signal of low output impedance to drive MN3000 series BBD. Built-in V_{GG} power supply circuit for the MN3000 series BBD* provides most suitable V_{GG} voltage for the BBD when the MN3101 is used with the same power source as BBD. Oscillation is abled by external resistors and capacitors, and also oscillation drive is possible by the separate excitation oscillation.
Clock signal frequency is 1/2 of oscillation frequency.

* MN3000 series BBDs
MN3001, MN3002, MN3003, MN3004, MN3005, MN3006 MN3007, MN3008, MN3009, MN3010, MN3011, MN3012.
Note) Clock signal generator is built-in the MN3003 and MN3012.

Unit: mm (inch)



8-Lead Dual-In-Line Plastic Package

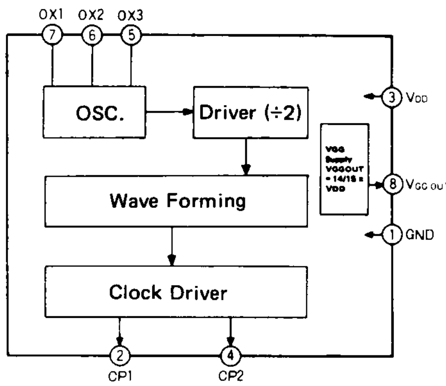
■ Features

- BBD direct driving capability of up to two MN3005s (equivalent to 8192-stages).
- Self and separate oscillations.
- Two phase clock output (Duty: 1/2).
- V_{GG} voltage generator is built-in for the BBD.
- Single power supply: −8 ~ −16V.
- 8-Lead Dual-In-Line Plastic Package.

■ Applications

- BBD clock generator/driver.

■ Block Diagram



■ Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Rating	Unit	Remarks
Drain Supply Voltage	V_{DD}	−18～+0.3	V	GND=0V
Input Terminal Voltage	V_I	V_{DD}−0.3～+0.3	V	GND=0V
Output Terminal Voltage	V_O	V_{DD}−0.3～+0.3	V	GND=0V
Power Dissipation	P_D	200	mW	
Operating Ambient Temperature	Topr	−10～+70	℃	
Storage Temperature	Tstg	−30～+125	℃	

■ Operating Condition (Ta = 25°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Drain Supply Voltage	V_{DD}	GND= 0 V	−8	−15	−16	V

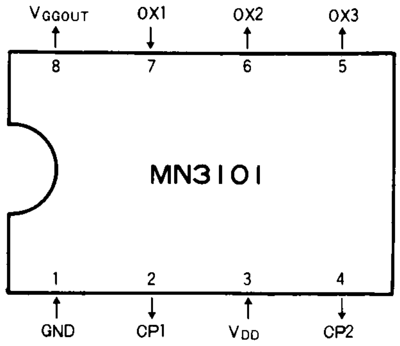
■ Electrical Characteristics (Ta = 25°C, V_{DD} = −15V, GND = 0V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Input drain current	I_{DD}	No loard		3		mA
Total Power Dissipation	P_{tot}	Clock output 40kHz		45		mW
OX1 Input Terminal						
Voltage "H" Level	V_{IH}		0		−1	V
Voltage "L" Level	V_{IL}		V_{DD}+1		V_{DD}	V
Input Leakage Current	I_{LK}	V_I= 0 ～−15V			30	μA
OX2 Output Terminal						
Output Current "H" Level	I_{OH1}	V_O=−1 V	0.6			mA
Output Current "L" Level	I_{OL1}	V_O=−14V	0.5			mA
Output Leakage Current	I_{LOL1}	V_O=V_{DD}			30	μA
Output Leakage Current	I_{LOH1}	V_O=GND			30	μA
OX3 Output Temrinal						
Output Current "H" Level	I_{OH2}	V_O=−1 V	1.5			mA
Output Current "L" Level	I_{OL2}	V_O=−14V	2			mA
Output Leakage Current	I_{LOL2}	V_O=V_{DD}			30	μA
Output Leakage Current	I_{LOH2}	V_O=GND			30	μA
CP1, CP2 Output Terminal						
Output Current "H" Level	I_{OH3}	V_O=−1 V	10			mA
Output Current "L" Level	I_{OL3}	V_O=−14V	10			mA
Output Leakage Current	I_{LOL3}	V_O=V_{DD}			30	μA
Output Leakage Current	I_{LOH3}	V_O=GND			30	μA
$V_{GG\ OUT}$ Output Terminal (*)						
Output Voltage	$V_{GG\ OUT}$			−14		V

(*) This terminal generates V_{GG} voltage exclusively applied for BBD manufactured by Matsushita Electronics Corporation, therefore, some times it might not be applicable for the device other than the V_{GG} voltage of MEC's BBD. $V_{GG\ OUT}$ changes by following formula depending on the value of V_{DD}.

$$V_{GG\ OUT} \doteqdot \frac{14}{15} V_{DD}$$

■ Terminal Assignments

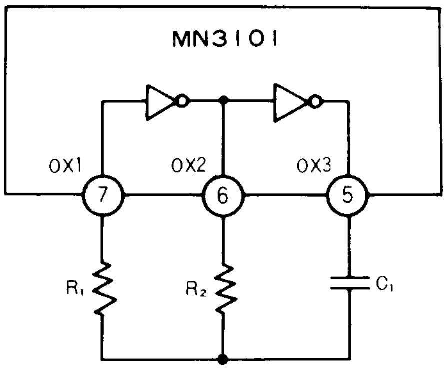


(Top View)

■ Terminal Description

Terminal No.	Symbol	I/O	Terminal Name	Description
1	GND	Power supply	Ground	Connected to GND of the circuit.
2	CP1	0	Clock output 1	This terminal outputs clock signal that is a revers phase of CP2 with Duty 1/2, 1/2 frequency of oscillation frequency
3	V_{DD}	Power supply	V_{DD} apply	−15V is applied.
4	CP 2	0	Clock output 2	This terminal outputs clock signal that is a reverse phase of CP 1.
5	OX 3	0	C and R is connected.	C, R are connected in case of selfoscillation. (Refer to oscillation circuit). In case of separate excitation, OX3 and OX2 are opened and OX1 is set to OSC input.
6	OX 2	0		
7	OX 1	1		
8	$V_{GG\ OUT}$	0	V_{GG} voltage output.	−14V is output. (V_{DD} = −15V) $V_{GG\ OUT}$ = 14/15V_{DD}.

■ Example of Oscillation Generation Circuit

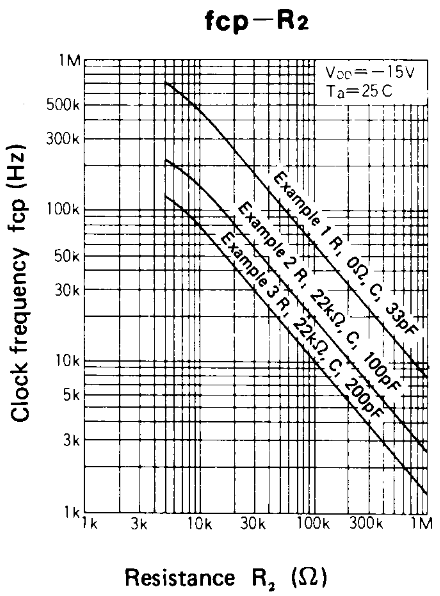


Oscillation circuit of the MN3101 is composed of 2-stage inverter and oscillation frequency is defined by the time constant of C1 and R2 shown left.

Following is an example of C1, R1 and R2.
Figure 1 shows f_{cp}* −R2 characteristics.

Example \ Constant	R_1 (Ω)	R_2 (Ω)	C_1 (pF)	f_{OSC}** (kHz)	f_{CP}* (kHz)
Example ①	0	5 k∼1 M	33	15∼1500	7.5∼750
Example ②	22k	5 k∼1 M	100	5.2∼440	2.6∼220
Example ③	22k	5 k∼1 M	200	1.4∼280	0.7∼140

* Clock output frequency of CP1 or CP2 terminals.
** Oscillation frequency of OX1, OX2 and OX3.



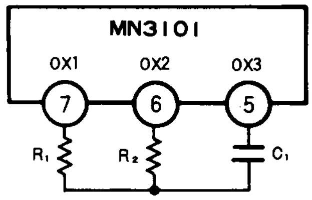


Figure 1 Example of characteristics of clock oscillation frequency.

■ The maximum clock frequency

The upper limit of the value of clock frequency is determined depending on the load capacitance and power consumption.

The permissible dissipation for this LSI is = P_D = 200mW.

If the clock frequency on the load capacitance is increased, the power consumption will be increased. (Refer to Figure 2.)

Accordingly, in order to utilize the MN3101 with dissipation less than the permissible value, it is necessary to select adequate values for the clock frequency and load capacitance.

Figure 3 shows an example of the dependence of the maximum clock frequency on the load capacitance in P_D = 150mW.

By connecting a resistance to the clock output terminal, it is made possible to increase the value of the maximum clock frequency without increasing dissipation. (Refer to Figures 2 and 3.)

It is because the dissipation on the LSI side is lessened, as a part of the power consumption required for driving the load capacitance is consumed by the series resistance.

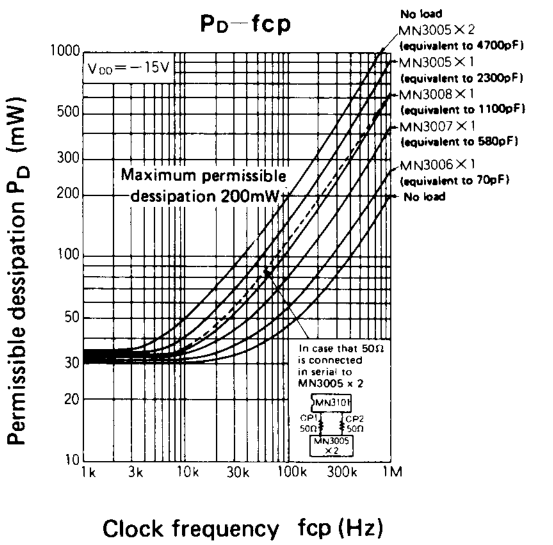


Figure 2 Example of the dependence of power consumption on the clock frequency.

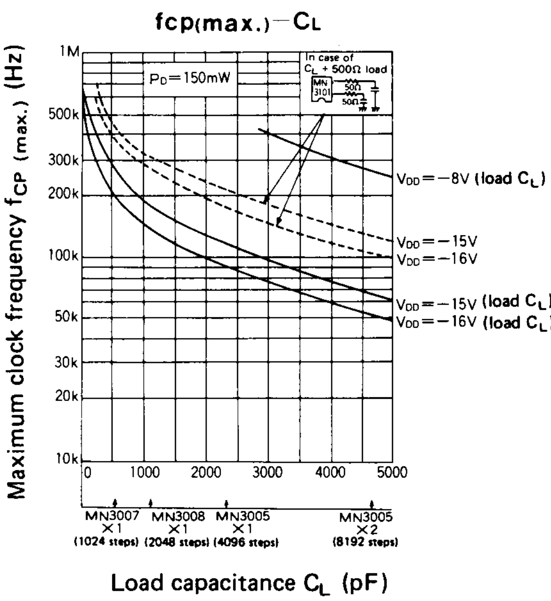


Figure 3 Example of the load capacitance characteristic of the maximum clock frequency in the power consumption of 150mW.

▷ MELODY IC TABLE*

Series	Type No.	Maximum Number of Tunes (Number of note)	Tune Selection: Binary Code	Tune Selection: Serial Trigger	Accompaniment	Preamplifier(internal)	BUSY END Signal	Transducer: Dynamic SP	Transducer: Magnetic	Transducer: Piezo	Envelope: External CR	Envelope: Digital Envelope	Oscillation: CR self	Oscillation: External Clock	Tune mode: Level hold	Tune mode: One-shot	Stop	Power Supply: 1.5V	Power Supply: 3V	Power Supply: 5V	Package: pin (DIP)	Note
	7910 series ≠	2 (128)	○	–	○	○	–	○	–	–	○	–	○	○	☆		–	○	○	–	16	•High quality tone •2 Alarms(pipon/pipipi) •Dynamic SP Drive
	7920 series	1 (64)	–		–	–	–	○	–	–	○	–	☆		☆		–	○	○	–	8	•Dynamic SP Drive (External)
	7930 series	1 (64)	–		–	○	–	○	–	–	○	–	☆		☆		–	○	○	–	14	•Dynamic SP Drive
SVM7940 Series	SVM7940	8 (512)	–	○	–	–	–	–	○	○	–	–	–	○	○	–	–	○	○	–	16	•Multi melody type •High impedance transducer drive
	SVM7941														–	○	○					
	SVM7942												○	–	○	–	–					
	SVM7943														–	○	○					
	SVM7944	4 (512)	○	–									–	○	○	–	–					
	SVM7945														–	○	○					
	SVM7946												○	–	○	–	–					
	SVM7947														–	○	○					
SVM7950 Series	SVM7950	1 (64)	–		–	○	–	–	○	○	–	–	–	○	○	–	–	○	○	–	16	•High impedance transducer drive
	SVM7951														–	○	○					
	SVM7952							○	–	–	○				○	–	–					
	SVM7953														–	○	○					
	SVM7954							–	○	○	–		○	–	○	–	–					
	SVM7955														–	○	○					
	SVM7956							○	–	–	○				○	–	–					
	SVM7957														–	○	○					
SVM7960 Series	SVM7960	4 (127)	○	–	○	○	○	○	–	–	○	–	–	○	○	–	–				16	•High quality tone •Dynamic SP Drive •1.5(V)/5(V)
	SVM7961														–	○						
	SVM7962												○	–	○	–						
	SVM7963														–	○						
	SVM7964	3 (127)	*1										–	○	○	–						
	SVM7965														–	○						
	SVM7966												○	–	○	–						*1 Address start
	SVM7967														–	○						
SVM7970 Series	SVM7970	8 (640)	–	○	○	○	○	○	–	–	☆		–	○	*3		○	☆			18	•Multi melody type •High quality tone •Dynamic SP Drive •1.5(V)/5(V) *2 Binary coder plus serial trigger *3 Selectable at each tune
	SVM7971												○	–								
	SVM7972	8 (640)	○	–									–	○								
	SVM7973												○	–								
	SVM7974	11 (640)	*2										–	○								
	SVM7975												○	–								
SVM7990 Series	SVM7990	8 (512)	–	○	–	○	–	○	–	–	○	–	–	○	○	–	–	○	○	–	16	•Multi melody type •Dynamic SP Drive
	SVM7991														–	○	○					
	SVM7992												○	–	○	–	–					
	SVM7993														–	○	○					
	SVM7994	4 (512)	○	–									–	○	○	–	–					
	SVM7995														–	○	○					
	SVM7996												○	–	○	–	–					
	SVM7997														–	○	○					
SVM7900 Series ≠	SVM7900	1 (64)	–		–	–	–	–	○	○	–	–	–	○	○	–	–	○	○	–	8	•High impedance transducer drive *4 OSC. resistor is built in (Mask option)
	SVM7901														–	○						
	SVM7902												*4 ○	–	○	–						
	SVM7903														–	○						

☆Mask option ≠ Ongoing user service product (Continue)

*Minimum melody IC order is 100,000 pieces. Please consult S-MOS for specific availability.

	Type No.	Maximum Number of Tunes (Number of note)	Tune Selection		Accompaniment	Preamplifier(internal)	BUSY END Signal	Transducer			Envelope		Oscillation		Tune mode		Stop	Power Supply			Package	Note
			Binary Code	Serial Trigger				Dynamic SP	Magnetic	Piezo	External CR	Digital Envelope	CR self	External Clock	Level hold	One-shot		1.5V	3V	5V	pin (DIP)	
SVM7800 Series	SVM7800												○	–								•High impedance transducer drive *5 Level hold or one shot pin selection
	SVM7801												–	○								
	SVM7802												○	–	○		–					
	SVM7803												–	○	*5							
	SVM7804	1	–		–	–	–	–	○	○	–	–	○	–				○	○	–	8	
	SVM7805	(63)											–	○								
	SVM7806												○	–		○						
	SVM7807												–	○	–		○					*6 One shot retrigger function
	SVM7808												○	–		○ *6						
	SVM7809												–	○								
SVM7820 Series	SVM7820												○	–								•LED drive •High impedance transducer drive *7 Level hold or one shot pin selection
	SVM7821												–	○								
	SVM7822												○	–	○		–					
	SVM7823												–	○	*7							
	SVM7824	1	–		–	–	–	–	○	○	–	–	○	–				–	○	–	–	
	SVM7825	(63)											–	○								
	SVM7826												○	–		○						
	SVM7827												–	○	–		○					
	SVM7828												○	–		○ *8						*8 One shot retrigger function
	SVM7829												–	○								
SVM7860 series	SVM7860	1	–		○	–	–	○	–	–	○	–	○	–	○	–	–		☆		8	•High quality tone •Dynamic SP Drive (External)
	SVM7861	(127)											–	○								

☆ Mask option

▷STANDARD MELODY LIST

Code No.	Song Title
7910C	Holdilidia
7910E	Two Minuets
	Dark eyebrows
7910G	Melodia A
	Melodia B
7910I	Home on the range
	Green Sleeves
7910K	lullaby (two songs)
7910N	Musunde Hiraite
	Cho-cho
*7910O	Westminster (two tunes)
*7910P	Westminster (accompaniment)
7910Q	Wiegenlied (Brahms)
	Rock a bye Baby
7910CE	Nocturne
	Minuet
7910T	Jingle Bells
7910CF	For Elise
	A maiden's prayer
7910CG	Romance de Amor
	Petrouchka
★7910CH	Westminster
	Ave Maria
★7910CM	Westminster
	Whittington
7910CN	Holdilidia
	Home on the range
7910CP	Silent lake-side
	Mountain Musician
7910CQ	Mary's little lamb
	De camptown races
7910CR	Lorelei
	Landler tanz
7910CS	Amaryllis
	Symphony # 40 (Mozart)
7910CU	Jingle Bells
	Silent night
7910CV	Joy to the world
	The first noel
7910CW	O Tannenbaum
	Frosty the snow man
7920A	The cuckoos waltz
7920B	Home sweet home
7920C	Jingle Bells
★7920M	Wedding march
★7920Q	Victory Song
7920AH	Wiegenlied (Brahms)
7930B	Home sweet home
7930C	Holdilidia
7930D	Lorelei
★7930E	Westminster
7930GA	Yurikago no uta
7930GB	Jingle Bells
7930GC	We wish you a merry X'mas
7930GD	Rudolph, the red-nosed Reindeer
7930GE	For Elise
7942COT	Holdilidia
	Minuet (Bach)
	Green Sleeves
	Symphony # 40 (Mozart)
	Home on the range
	Silent lake-side
	Mountain Musician
	Happy birthday to you
☆7943COE	Green Sleeves
	De camptown races
	For Elise

Code No.	Song Title
☆7943COE	Romance de amor
	O sole mio
	Die Lorelei
	The cuckoos waltz
	Old folk at home
☆7943COS	Spring
	Hymne a Lamour
	La Mer
	Farandolles
	Yesterday
	L'eau Vive
	O Tannenbaum
	Symphony # 40 (Mozart)
☆7943CON	Hymne a lamour
	Santa lucia
	Hey Jude
	L'eau Vive
	Romance de amor
	Yesterday
	Happy birthday to you
	Wedding march
7942DAN	Jingle Bells
	Joy to the world
	O Tannenbaum
	We wish you a Merry X'mas
	Silent Night
	The First Noel
	Frosty the snow man
	Rudolph the red nosed reindeer
7950COB	Les ferilles mortos
7950COD	Blue bell of Scotland
7950COF	Yodel
7950COH	Cantate # 147 (Bach)
☆7951COC	Mexican hat dance
☆7951COQ	Cantate # 147 (Bach)
7952COG	Cantate # 147 (Bach)
7954CAR	Green Sleeves
☆7955COJ	O'sole mio
☆7955COL	Happy birthday to you
☆7955COX	Saint go'in march'in in
☆7955COY	Music box dancer
☆7955CAF	Mountain Musician
☆7955CAN	Jingle Bells
☆7955CBC	Wedding March
7962COA	Green Sleeves
	Home on the range
	Ding Dong
	Two Minuets
7975COB	Landler tanz
	Amaryllis
	Home on the range
	Green Sleeves
	For Elise
	A maiden's prayer
	Mountain Musician
	Yodel
	Ding Dong
	Beep sound
	Westminster
7992COA	X'mas song medley (8 tunes)
☆7993COC	Green Sleeves
	De camptown races
	For Elise
	Romance de amor
	O sole mio
	Lorelei
	The cuckoos waltz

Code No.	Song Title
☆7993COC	Mountain Musician
7993CON	Westminster
	A malden's prayer
	For Elise
	Romance de amor
	Amaryllis
	Symphony # 40 (Mozart)
	Dark eyebrows
	De camptown races
7993DAC	Yellow Rose of Texas-Dixie Land
	Stars and Stripes forever-Anchors Awaign
	She wore a yellow ribbon-Twinkle twinkle little star
	London Bridge is falling down-Mountain musician
	Row row row a boat-It's a small world
	Home sweet home-Wiegenlied
7993DAE	Rudolph, The red nosed reindeer-Santa Claus is coming to town
	We wish you a Merry X'mas-Frosty the snow man
	Jingle Bells-Silent Night
	Joy to the world-The first Noel
	O christmas tree-Hark the herald Angels sing
	O tannenbaum-Oh little town of Bethlehem
7902COA	X'mas song medley. Red nosed reindeer. O Tannenbaum Jingle bells.
⍟7903COB	Happy birthday
✪7903COC	Wedding March
★7903COE	Happy birthday
★7903COG	Hymne a lamour
☆7903COH	The Alphabet Song
☆7903COJ	Rock a bye Baby
☆7903COK	Old Macdonald Had a Farm
✪7903COS	Mountain Musician
★7903COY	Jingle Bells
★7903CAA	Love me tender
★7903CAB	Love Story
★7903CAC	Wedding March
★7903CAE	Congratulations
★7903CAH	Silent Night
★7903CAL	Saint go'in march'in in
★7903CAN	Jingle bells, Red nosed reindeer, Joy to the world.
★7903CAP	Music box dancer
★7903CAR	Wedding march (Long version)
★7903CAS	Let me call you my Sweet heart
☆7903CBA	Jingle Bells.
☆7903CBB	Silent Night
☆7903CBN	Hymne a lamour
★7903CBP	Mother of mine
☆7903DBQ	Happy birthday
☆7903DBR	Music box dancer
☆7903DBS	Wedding March
☆7903DBT	Jingle Bells, Red Nosed Reindeer, Joy to the world
☆7903DBY	For Elise
7902DCF	Christmas song medley
★7903DCK	Easter Paradise
7902DCS	Rock A bye baby
★7903DCT	Santa Claus is coming to town
★7903DCV	The First Noel
★7903DCY	When you wish up on a star
★7903DEA	You light up my life
★7903DEB	Wargner's Wedding March
7902DEC	Christmas Medley
☆7903DEH	Congratulation

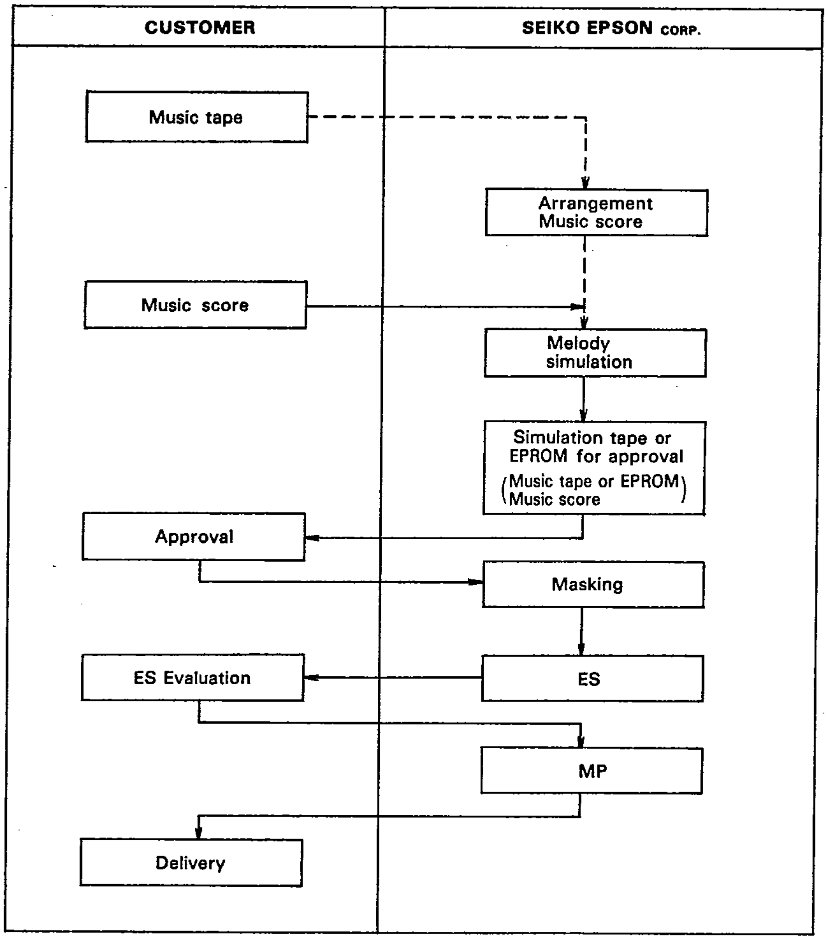
*Type 7910P will be used as accompaniment with type 7910O.
Note: 7910 Series and SVM7900 Series are ongoing user service products.

☆One shot mode. (A type)
★One shot mode (B type)
⍟, ✪OSC, resistor is not included on IC

▷STANDARD MELODY LIST

Code No	Song Title	Code No	Song Title	Code No	Song Title
7800DCS	Silent Night	7820DSB	Jingle Bells Medley		
7800DCT	Rock a Bye Baby	7820DSC	Music Box Dancer		
7800DCV	If You Love Me	7820DSE	Jingle Bells		
7800DCY	Brahms' Lullaby	7820DSF	Silver Bells		
7800DEA	Love Story	7820DSG	It's a Small World		
7800DEB	Happy Birthday to You	7820DSH	Over The Rainbow		
7800DEC	Jingle Bells	7820DSJ	Easter Parade/Peter Cottontail		
7800DEN	Old Macdonald				
7800DEP	Twinkle Twinkle Little Star				
7800DEO	Romance D'amor				
7800DER	White Christmas				
7800DES	Wedding March (Wagner)				
7800DET	Wedding March (Mendelssohn)				
7800DEV	You are my Sunshine				
7800DFB	O Tannenbanm/Silent Night				
7800DFC	Silver Bells				
7800DFF	Aure Lee				
7800DFG	Let me call you my sweet heart				
7800DFL	Mary Had a Little Lamb				
7800DFP	Jesus Loves Me				
7800DFT	Yesterday				
7800DFV	Music Box Dancer				
7800DFY	My Way				
7800DGA	Easter Parade / Peter Cottontail				
7800DGB	Love Me Tender/Let Me Call You My Sweet	7860CSB	Nocturne		
7802DFE	For Elise	7860CSC	Minuet		
		7860CSE	Home on the Range		
		7860CSF	Green Sleeves		
		7860CSG	The Entertainer		
		7860CSH	Loreleï		
		7860CSK	For Elise		
		7860C6C	Tableaux d'une Exposition(Promenade)		
		7860C6E	Je te Veux		
		7860C6F	The Jewels of the Madonna		
		7860C6G	When I'm Sixty–four		
		7860C6H	Minuet (Boccherini)		

MELODY IC DESIGN FLOW



EPSON

SVM7940C Series

Multi-Melody IC

Low Voltage Operation Products

- **512 Words Melody ROM**
- **Piezo Transducer Direct Drive**
- **4 Melodies Max. (Binary Code Selection)**
  8 Melodies (Serial Trigger Selection)

■ DESCRIPTION

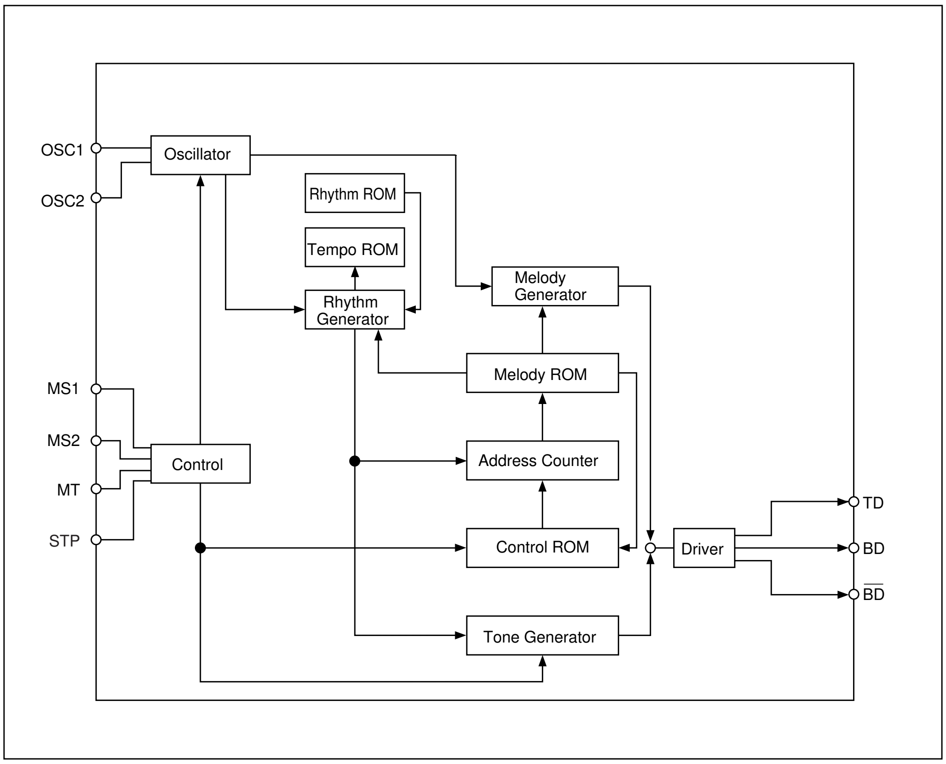
The SVM7940C Series are CMOS IC circuits which contain a programmed ROM for playing tunes. It is designed for electronic watches or music boxes. The SVM7940C series has 512 notes and a maximum of 4 or 8 melodies may be selected by switch.

NOTE: These are ongoing user service products.

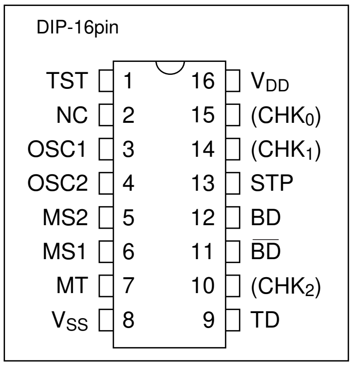
■ FEATURES

- Mask programmable up to 512 notes
- Maximum 4 or 8 melodies can be selected by switch
- Can be driven by DC pulse or AC pulse (Mask selection)
- Piezo transducer direct drive
- NPN transistor coil drive
- Melody can be stopped halfway by switching (Only applied to one-shot mode)
- Sound demonstration capability
- Mono tone
- Available for high impedance buzzers
- Hourly chime (Option)
- Package .... DIP-16pin (plastic)

■ BLOCK DIAGRAM



■ PIN CONFIGURATION



■ ABSOLUTE MAXIMUM RATINGS

(V_{SS} =0V)

Rating	Symbol	Value	Unit
Supply voltage	V_{DD}	–0.3 to 5.0	V
Input/Output voltage	$V_{I/O}$	–0.2 to V_{DD}+0.2	V
Operating temperature	T_{opr}	–20 to +65	°C
Storage temperature	T_{stg}	–65 to +150	°C
Soldering temperature and time	T_{sol}	260°C, 10s (at lead)	—

■ ELECTRICAL CHARACTERISTICS

(V_{SS} =0V, Ta =25°C)

Characteristic	Symbol	Condition			Min.	Typ.	Max.	Unit
Operating voltage	V_{DD}				1.2	1.5	2.0	V
"1" input voltage	V_{IH}				V_{DD}-0.1	—	V_{DD}	V
"0" input voltage	V_{IL}				V_{SS}	—	V_{SS}+0.1	V
"1" input current (Terminal OSC1)	I_{IH1}	V_{DD}=1.5V, V_{IH1}=V_{DD}			—	—	0.05	µA
"1" input current (Terminal SEL1, SEL2)	I_{IH2}	V_{DD}=1.5V V_{IH2}=V_{DD}	Serial tigger selection		1.5	—	15	µA
			Binary code selection	Standby	—	—	0.05	
				Play	1.5	—	15	
"1" input current (Terminal STP)	I_{IH3}	V_{DD}=1.5V V_{IH3}=V_{DD}		Standby	—	—	0.05	µA
				Play	1.5	—	15	
"1" input current (Terminal MT, TST)	I_{IH4}	V_{DD}=1.5V, V_{IH4}=V_{DD}			1.5	—	15	µA
"1" input current (Terminal TST, OSC1, SEL1, SEL2, MT, STP)	I_{IL}	V_{DD}=1.5V V_{IL}=V_{SS}			—	—	0.05	µA
"1" output current (Terminal OSC2)	I_{OH1}	V_{DD}=1.2V, V_{OH1}=1.1V			3.0	—	30	µA
"0" output current (Terminal OSC2)	I_{OL1}	V_{DD}=1.2V, V_{OL1}=0.1V			3.0	—	30	µA
Input amplitude	A_I	V_{DD}=1.5V, when external reference signal applied to OSC1			$\left\|\frac{V_{DD}}{2}\right\|$±0.3	—	—	V
Average current drain during standby	I_{STB}	V_{DD}=1.5V, All terminals open			—	—	0.3	µA
Average current drain during play	I_{OPR}	V_{DD}=1.5V, f_{OSC}=32.768kHz V_{DD} connected to terminal MT			—	40	80	µA

■ OSCILLATION CHARACTERISTICS (CR Oscillation)

(V_{SS} =0V, Ta=25°C)

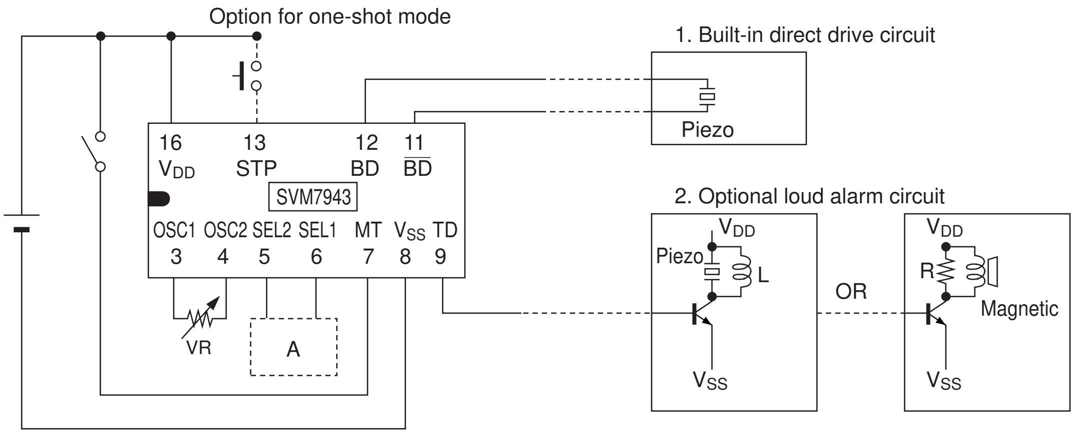
Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Oscillator frequency	f_{OSC}	V_{DD}= 1.5V VR=620kΩ	–30	32.768kHz	+30	%
Oscillator self-start voltage	V_{STA}	VR=620kΩ	1.2	—	—	V
Oscillator stop voltage	V_{STP}	VR=620kΩ	—	—	1.2	V

■ SVM7940 SERIES (Mask selection)

Type	Oscillation	Tune mode	Tune selection
SVM7942	CR self OSC.	Level hold	Serial trigger selection
SVM7943	CR self OSC.	One-shot	Serial trigger selection

■ BASIC EXTERNAL CONNECTION

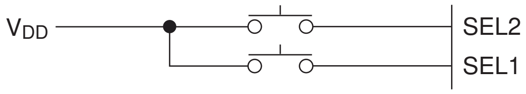
● SVM7942, SVM7943



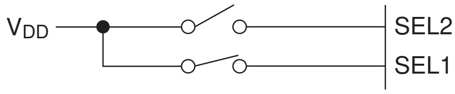
VR: 1MΩ, R: 1kΩ, L: 30 to 100mH

■ CIRCUIT FOR SELECTION: at a position A of above block diagram 1 & 2.

(1) Serial trigger selection



(2) Binary code selection

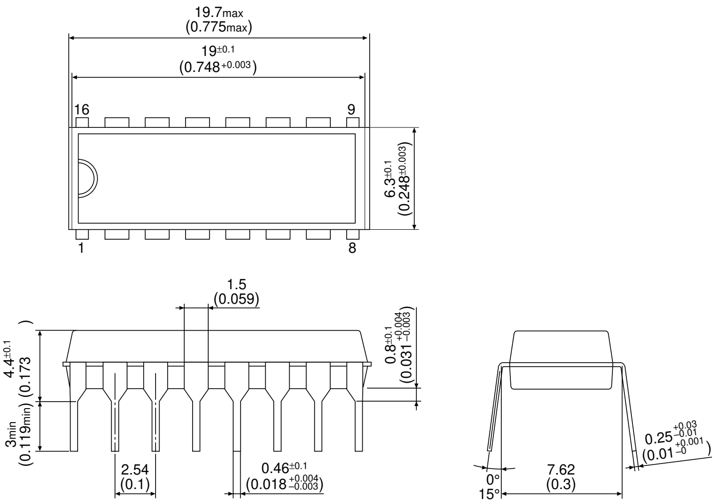


■ SELECTION OF SONG AND SOUND DEMONSTRATION (Mask selection)

Options \ Terminal	SEL2	SEL1	MT
(1)	Select song only	Sound demo only	Alarm input or sound demo input
(2)	Select song only	Select song and sound demo	
(3)	Only when both SEL1 and SEL2 are triggered, select song and sound demo, or select song only.		
(4)	Select song by binary code of SEL1 and SEL2 (Max.4 tunes)		

■ PACKAGE DIMENSIONS

Plastic DIP-16pin



Unit: mm
(inch)

NOTICE

SEIKO EPSON CORPORATION

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421-8, Hino, Hino-shi, Tokyo 191-8501, JAPAN
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Electric Device Information of EPSON WWW server

http://www.epson.co.jp

BIPOLAR LINEAR INTEGRATED CIRCUIT
SILICON MONOLITHIC

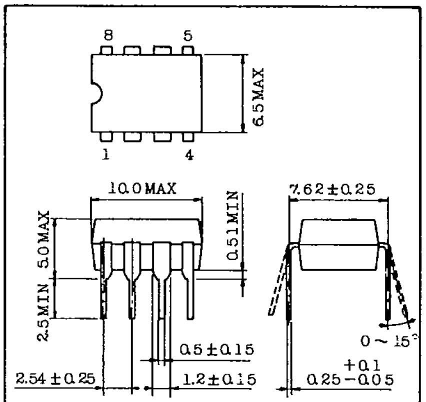
TA7504P/S

T-79-05-10

SINGLE OPERATIONAL AMPLIFIER
OPERATIONAL AMPLIFIER
DC AMPLIFIER

- High Gain : $G_V=1\times10^5$ (Typ.)
- Low Power Dissipation : P_D=50mW (Typ.)
- High Common Mode Input Voltage : $CMV_{IN}=\pm13V$ (Typ.)
- High Differential Input Voltage: DV_{IN}=30 (Typ.)
- Low Input Offset Voltage : V_{IO}=1mV (Typ.)
- No Frequency Compensation
- Absence of Latch-up
- Offset Null Capability
- Short Circuit Protection

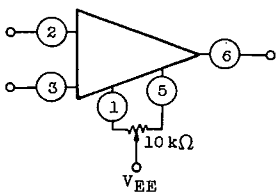
Unit in mm



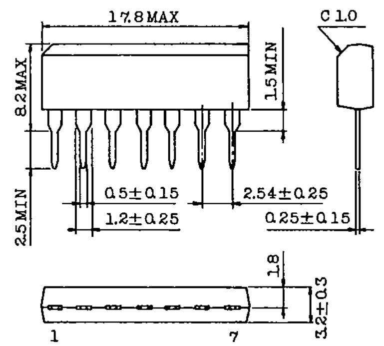
Lead pitch is 2.54 and tolerance is ±0.25 against theoretical center of each lead that is obtained on the basis of No.1 and No.8 leads.

JEDEC	—
TOSHIBA	3D8A-P

VOLTAGE OFFSET NULL CIRCUIT



Unit in mm



Lead pitch is 2.54 and tolerance is ±0.25 against theoretical center of each lead that is obtained on the basis of No.1 lead.

JEDEC	—
TOSHIBA	S7A-P

MAXIMUM RATINGS (Ta=25°C)

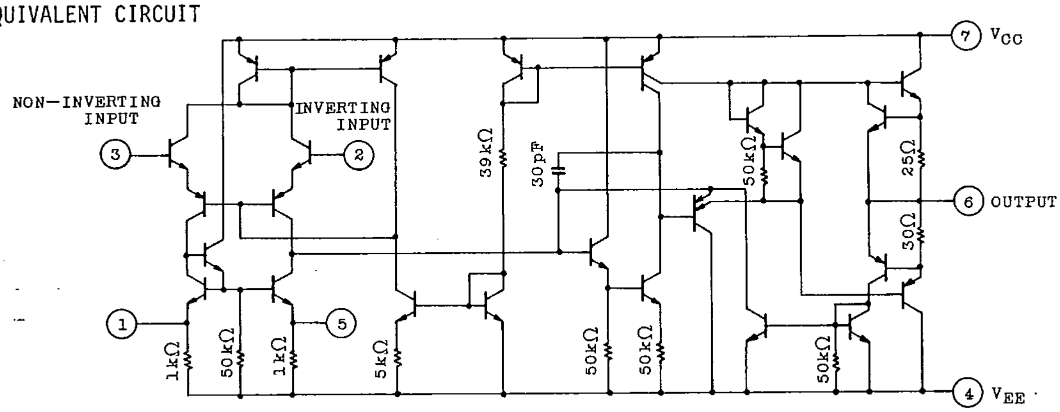
CHARACTERISTIC		SYMBOL	RATING	UNIT
Supply Voltage		V_{CC}, V_{EE}	±18	V
Differential Input Voltage		DV_{IN}	±30	V
Input Voltage		V_{IN}	$V_{CC}\sim V_{EE}$	V
Power Dissipation	TA7504P	P_D	300	mW
	TA7504S		400	
Operating Temperature		T_{opr}	-30 ~75	°C
Storage Temperature		T_{stg}	-55 ~125	°C

TA7504P/S

ELECTRICAL CHARACTERISTICS (V_{CC}=15V, V_{EE}=-15V, Ta=25°C)

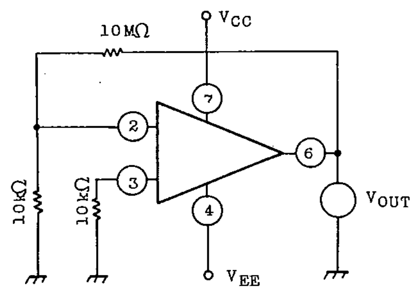
CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Offset Voltage	V_{IO}	1	$R_g \leq 10k\Omega$	-	1	5	mV
Input Offset Current	I_{IO}	2	-	-	30	200	nA
Input Bias Current	I_I	2	-	-	200	500	nA
Common Mode Input Voltage	CMV_{IN}	3	-	±12	±13	-	V
Maximum Output Voltage	V_{OM}	4	$R_L \geqq 10k\Omega$	±12	±14	-	V
	V_{OMR}		$R_L \geqq 2k\Omega$	±10	±13	-	
Maximum Output Voltage Swing	V_{Op-p}	5	R_L=10kΩ, f=1kHz	24	28	-	V
Output Short Circuit Current	I_{OS}	4	-	-	±20	-	mA
Input Impedance	Z_{IN}	-	f=1kHz	0.3	1	-	MΩ
Output Impedance	Z_{OUT}	-	f=1kHz	-	60	-	Ω
Voltage Gain	G_V	-	R_L=2kΩ, V_{OUT}=±10V f=10kHz	20	100	-	$\times 10^3$
Common Mode Input Signal Rejection Ratio	CMRR	3	CMV_{IN}=±10V, f=100Hz	70	90	-	dB
Supply Voltage Rejection Ratio	SVRR	1	$R_g \leq 10k\Omega$	-	30	150	μV/V
Power Dissipation	P_D	6	-	-	50	85	mW
Temperature Coefficient of Input Offset Voltage	$\Delta V_{IO}/\Delta T$	1	$R_g \leq 10k\Omega$, Ta=-30 ~ 75°C	-	5	50	μV/°C
Slew Rate	SR	7	R_L=2kΩ	-	0.5	-	V/μs
Rise Time	t_r	8	C_L=100pF, R_L=2kΩ	-	0.3	-	μs
Over Short	e_{over}			-	5	-	%
Input Noise Voltage	e_{np-p}	9	R_g=10kΩ, f=0 ~100Hz	-	6	-	μV

EQUIVALENT CIRCUIT



TEST CIRCUIT

(1) V_{IO}, $\Delta V_{IO}/\Delta T$, SVRR



$V_{IO}=V_{OUT}/1000$

$$SVRR = \frac{V_{OUT}-V_{OUT}2}{1000 \times 5}$$

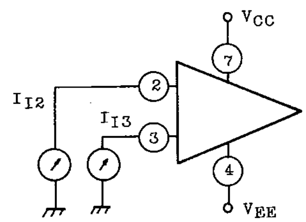
$V_{OUT}1$; (V_{CC}, $-V_{EE}$ = 17.5(V)

$V_{OUT}2$; (V_{CC}, $-V_{EE}$ = 12.5(V)

$\Delta V_{IO}/\Delta T = |V_{IO}(25^\circ C)-V_{IO}(-30^\circ C)|/55$

$\Delta V_{IO}/\Delta T = |V_{IO}(25^\circ C)-V_{IO}(75^\circ C)|/50$

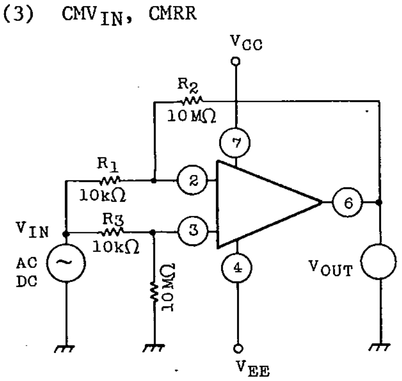
(2) I_I, I_{IO}



$I_{IO}=|I_{I2}-I_{I3}|$

$$I_I = \frac{I_{I2}+I_{I3}}{2}$$

(3) CMV_{IN}, CMRR

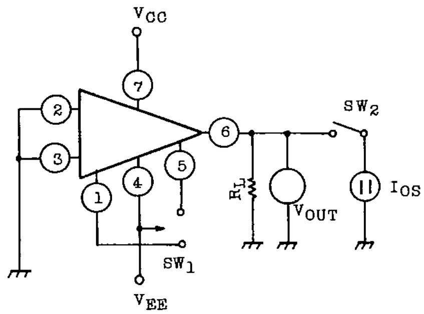


CMV_{IN} : $V_{OUT}=\pm 10(V_{DC})$, V_{IN} MEASURED

CMRR : $V_{IN}=7.07(V_{rms})$, V_{OUT} MEASURED

$$CMRR = 20\,\ell og \frac{V_{IN}}{\frac{V_{OUT}}{1000}} = 20\,\ell og \frac{7070}{V_{OUT}} \text{ (dB)}$$

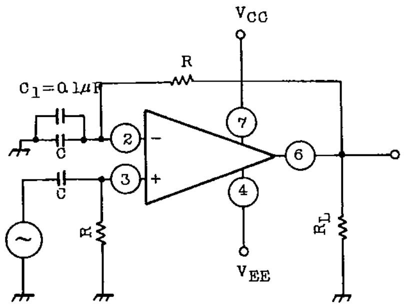
(4) V_{OM}, V_{OMR}, I_{OS}



V_{OM}, V_{OMR} : SW_2 : OPEN CIRCUIT
SW_1 : TERMINAL 1 OR 5

I_{OS} : SW_2 : SHORT CIRCUIT
SW_1 : TERMINAL 1 OR 5

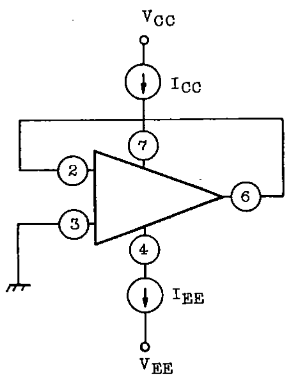
(5) G_V, V_{Op-p}



C : DC COUPLE

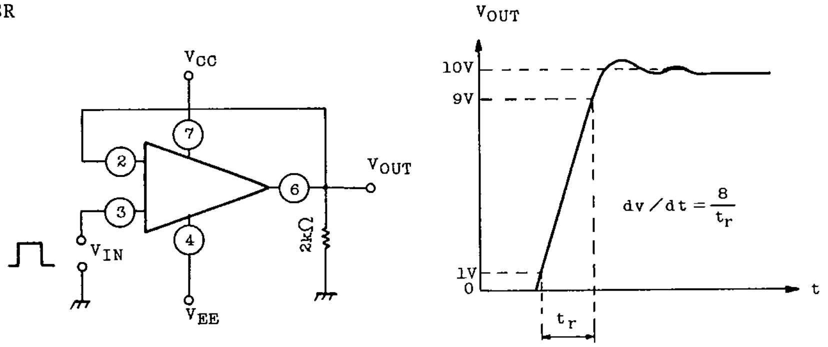
C_I : HF BYPASS
$\omega \gg 1/RC$
$G_V = V_{OUT}/V_{IN}$

(6) P_D

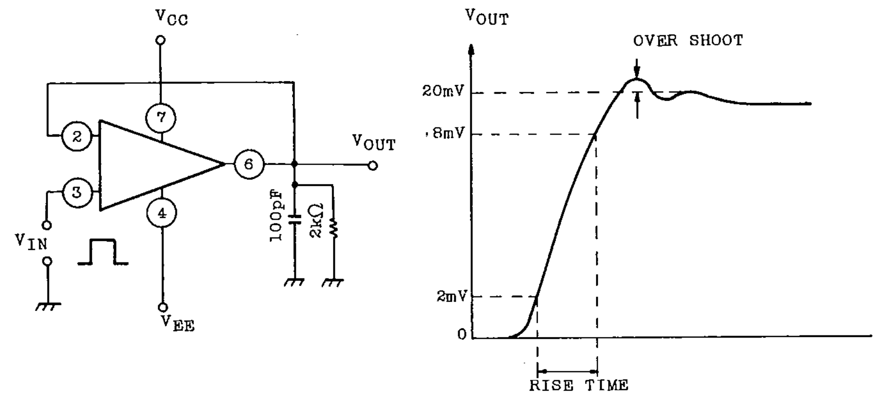


$P_D = (V_{CC} - V_{EE})\ I_{CC}$
$= (V_{CC} - V_{EE})\ I_{EE}$

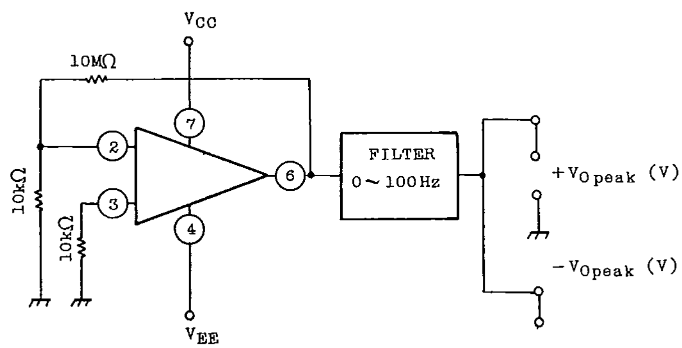
(7) SR



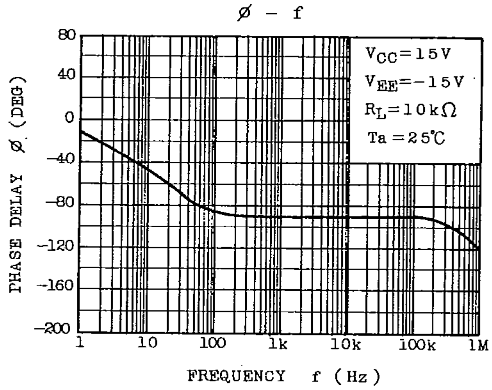
(8) RESPONSE TIME

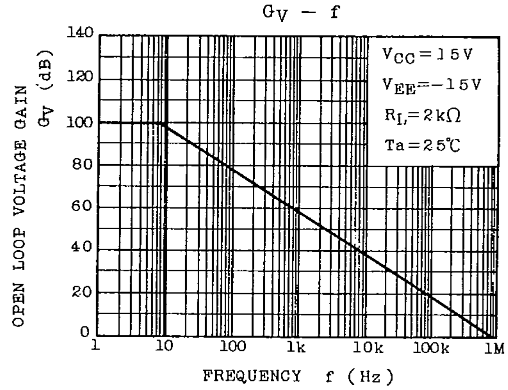


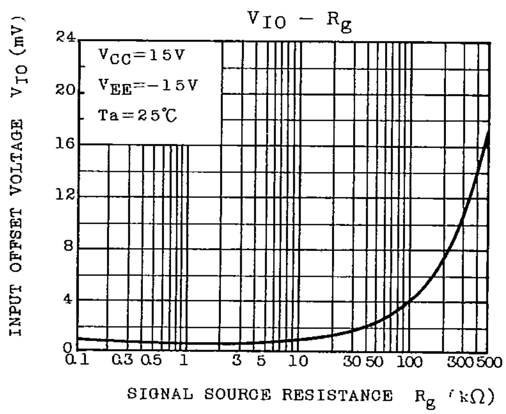
(9) e_{np-p}

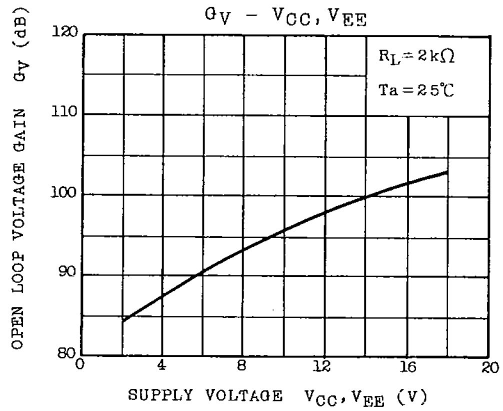


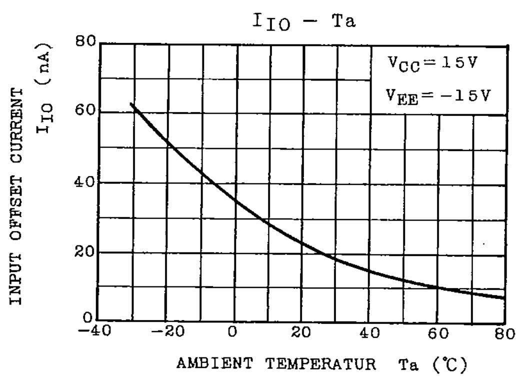
$e_{np-p} = (|+V_{Opeak}| + |-V_{Opeak}|) \times 10$ (V)

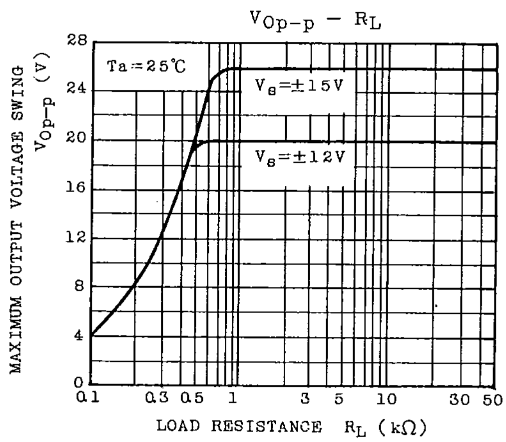

ø − f
PHASE DELAY ø (DEG)
80
40
0
−40
−80
−120
−160
−200
1
10
100
1k
10k
100k
1M
FREQUENCY f (Hz)
V_{CC}=15V
V_{EE}=−15V
R_L=10kΩ
Ta=25℃

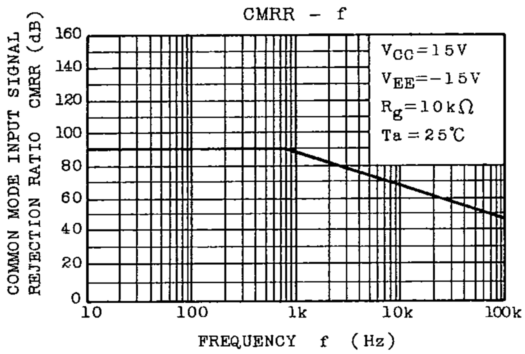

G_V − f
OPEN LOOP VOLTAGE GAIN G_V (dB)
140
120
100
80
60
40
20
0
1
10
100
1k
10k
100k
1M
FREQUENCY f (Hz)
V_{CC}=15V
V_{EE}=−15V
R_L=2kΩ
Ta=25℃

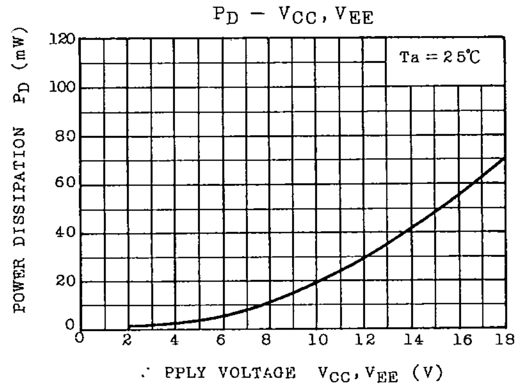

V_{IO} − R_g
INPUT OFFSET VOLTAGE V_{IO} (mV)
24
20
16
12
8
4
0
0.1
0.3 0.5
1
3 5
10
30 50
100
300 500
SIGNAL SOURCE RESISTANCE R_g (kΩ)
V_{CC}=15V
V_{EE}=−15V
Ta=25℃

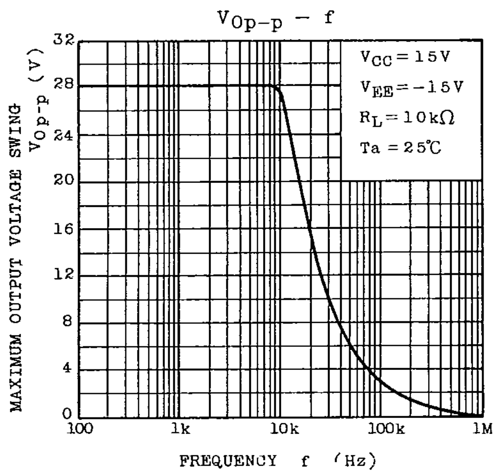

G_V − V_{CC}, V_{EE}
OPEN LOOP VOLTAGE GAIN G_V (dB)
120
110
100
90
80
0
4
8
12
16
20
SUPPLY VOLTAGE V_{CC}, V_{EE} (V)
R_L=2kΩ
Ta=25℃

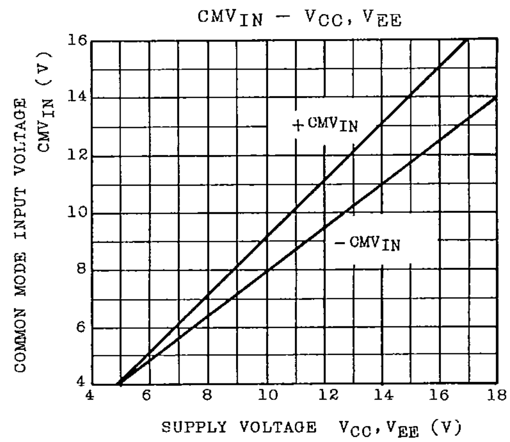

I_{IO} − Ta
INPUT OFFSET CURRENT I_{IO} (nA)
80
60
40
20
0
−40
−20
0
20
40
60
80
AMBIENT TEMPERATUR Ta (℃)
V_{CC}=15V
V_{EE}=−15V

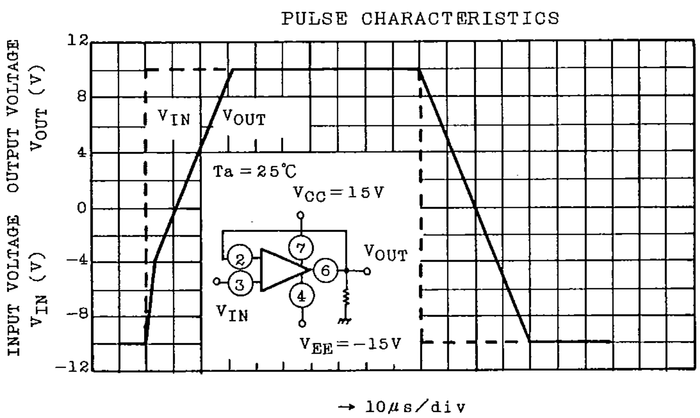

V_{Op-p} − R_L
MAXIMUM OUTPUT VOLTAGE SWING V_{Op-p} (V)
28
24
20
16
12
8
4
0
0.1
0.3 0.5
1
3
5
10
30 50
LOAD RESISTANCE R_L (kΩ)
Ta=25℃
V_s=±15V
V_s=±12V


CMRR – f
COMMON MODE INPUT SIGNAL REJECTION RATIO CMRR (dB)
V_{CC}=15V
V_{EE}=−15V
R_g=10kΩ
Ta=25℃
FREQUENCY f (Hz)
10
100
1k
10k
100k
0
20
40
60
80
100
120
140
160


P_D – V_{CC}, V_{EE}
POWER DISSIPATION P_D (mW)
Ta=25℃
SUPPLY VOLTAGE V_{CC}, V_{EE} (V)
0
2
4
6
8
10
12
14
16
18
20
40
60
80
100
120


V_{Op-p} – f
MAXIMUM OUTPUT VOLTAGE SWING V_{Op-p} (V)
V_{CC}=15V
V_{EE}=−15V
R_L=10kΩ
Ta=25℃
FREQUENCY f (Hz)
100
1k
10k
100k
1M
0
4
8
12
16
20
24
28
32


CMV_{IN} – V_{CC}, V_{EE}
COMMON MODE INPUT VOLTAGE CMV_{IN} (V)
+CMV_{IN}
−CMV_{IN}
SUPPLY VOLTAGE V_{CC}, V_{EE} (V)
4
6
8
10
12
14
16
18


PULSE CHARACTERISTICS
INPUT VOLTAGE V_{IN} (V) OUTPUT VOLTAGE V_{OUT} (V)
V_{IN}
V_{OUT}
Ta=25℃
V_{CC}=15V
V_{EE}=−15V
V_{IN}
V_{OUT}
2
3
4
6
7
12
8
4
0
−4
−8
−12
→ 10μs/div

TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

TA75558P, TA75558S, TA75558F

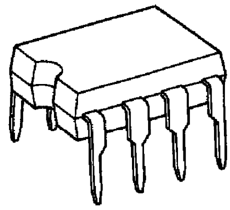
DUAL OPERATIONAL AMPLIFIER

The TA75558P, TA75558S and TA75558F are Low-Noise Operational Amplifiers with High Speed and Wide Bandwidth.

FEATURES

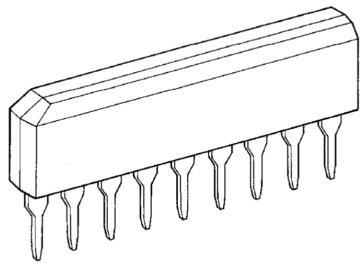
- Internal Frequency Compensation Type
- Pin Compatible with TA75458P, TA75458S and TA75458F
- Possible to Exchange the Position of 9 Pin for 1 Pin Because of Pin Connection Being Symmetric. (TA75558S Device Only)
- Wide Band Range : $f_T = 3MHz$ (Typ.)
- Suitable Application for Active Filter Equalizer Amplifier and Headphone Amplifier.

TA75558P



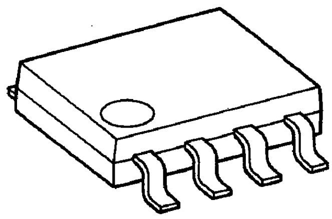
DIP8-P-300-2.54A

TA75558S



SIP9-P-2.54A

TA75558F

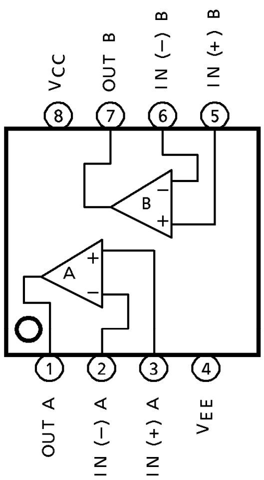


SOP8-P-225-1.27

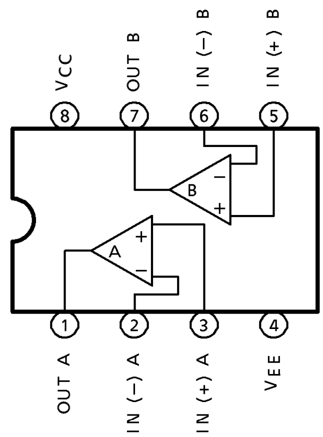
Weight
DIP8-P-300-2.54A : 0.5g (Typ.)
SIP9-P-2.54A : 0.9g (Typ.)
SOP8-P-225-1.27 : 0.1g (Typ.)

PIN CONNECTION (TOP VIEW)

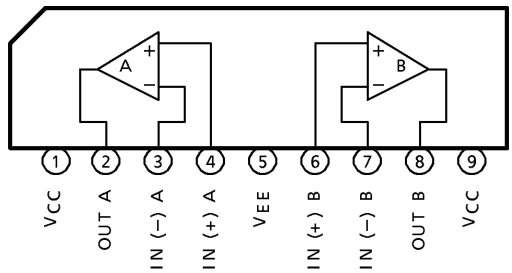
TA75558F



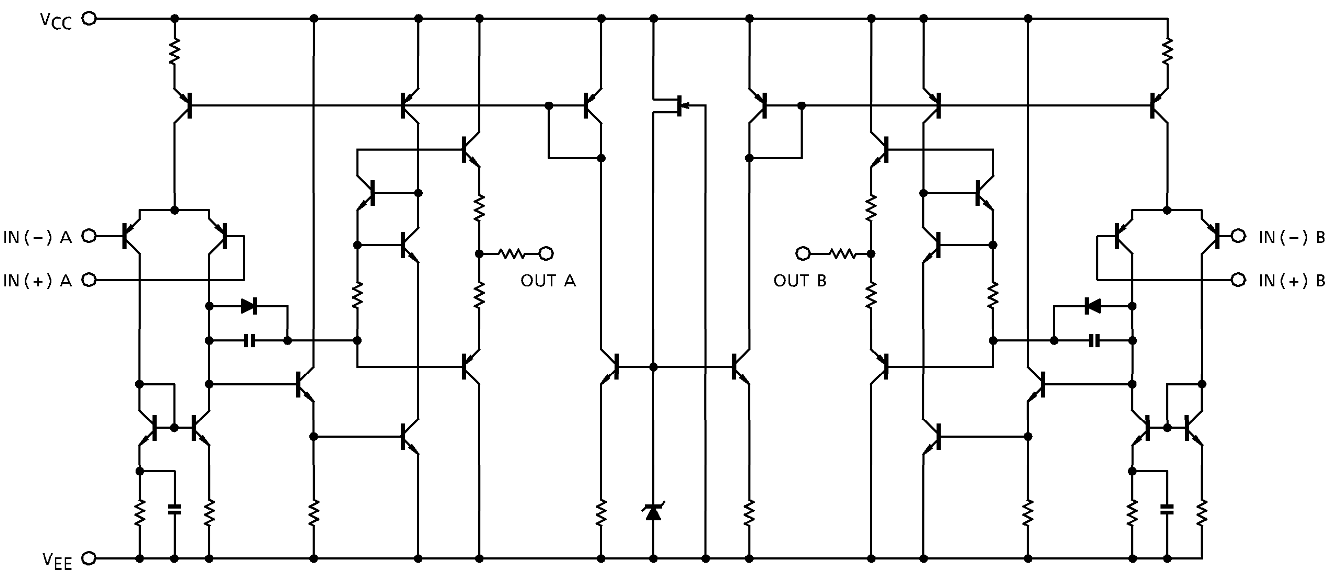
TA75558P



TA75558S



EQUIVALENT CIRCUIT



MAXIMUM RATINGS (Ta = 25°C)

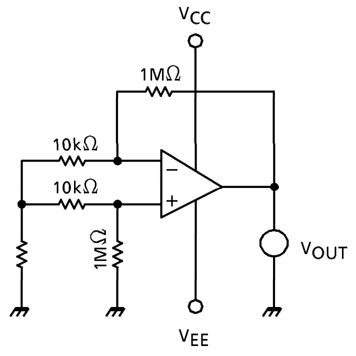
CHARACTERISTIC	SYMBOL	TA75558P TA75558S	TA75558F	UNIT
Supply Voltage	V_{CC}	+18	+18	V
	V_{EE}	−18	−18	
Differential Input Voltage	DV_{IN}	±30	±30	V
Input Voltage	V_{IN}	V_{CC}~V_{EE}	V_{CC}~V_{EE}	V
Power Dissipation	P_D	500	240	mW
Operating Temperature	T_{opr}	−40~85	−30~70	°C
Storage Temperature	T_{stg}	−55~125	−55~125	°C

ELECTRICAL CHARACTERISTICS (V_{CC} = 15V、V_{EE} = −15V、Ta = 25°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Offset Voltage	V_{IO}	1	$R_g \leqq 10k\Omega$	—	0.5	6	mV
Input Offset Current	I_{IO}	2	—	—	5	200	nA
Input Bias Current	I_I	2	—	—	60	500	nA
Common Mode Input Voltage	CMV_{IN}	3	—	±12	±14	—	V
Maximum Output Voltage	V_{OM}	6	$R_L = 10k\Omega$	±12	±14	—	V
	V_{OMR}		$R_L = 2k\Omega$	±10	±13	—	
Source Current	I_{source}	8	—	—	40	—	mA
Sink Current	I_{sink}	7	—	—	40	—	mA
Voltage Gain (Open Loop)	G_V	5	$V_{OUT} = \pm 10V$, $R_L = 2k\Omega$	86	100	—	dB
Common Mode Input Signal Rejection Ratio	CMRR	3	$R_g \leqq 10k\Omega$	70	90	—	dB
Supply Voltage Rejection Ratio	SVRR	1	$R_g \leqq 10k\Omega$	—	30	150	μV / V
Slew Rate	SR	9	$G_V = 1$, $R_L = 2k\Omega$	—	1.0	—	V / μs
Unity Gain Cross Frequency	f_T	5	Open Loop	—	3.0	—	MHz
Supply Current	I_{CC}, I_{EE}	4	—	—	4.0	6.0	mA
Equivalent Input Noise Voltage	V_{NI}	—	$R_S = 1k\Omega$, f = 30Hz~30kHz	—	2.5	—	μV_{rms}

TEST CIRCUIT

(1) V_{IO}, S_{VRR}

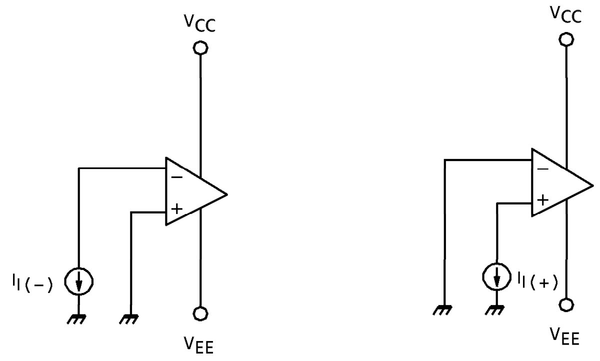


- $V_{IO} = V_{OUT} / 100$
- $SVRR = 20\ell og\ E\ (dB)$

$$E = \left| \frac{V_{OUT1} - V_{OUT2}}{(V_{CC1} - V_{EE1}) - (V_{CC2} - V_{EE2})} \right| \times \frac{1}{100}$$

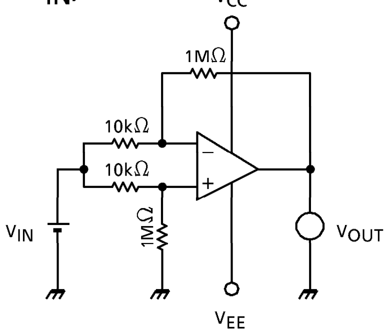
V_{OUT1} : V_{OUT} (V_{CC}, $V_{EE} = \pm 8V$)
V_{OUT2} : V_{OUT} (V_{CC}, $V_{EE} = \pm 18V$)
V_{CC1} : $V_{CC} = -8V$
V_{EE1} : $V_{EE} = -8V$
V_{CC2} : $V_{CC} = +18V$
V_{EE2} : $V_{EE} = -18V$

(2) I_I, I_{IO}



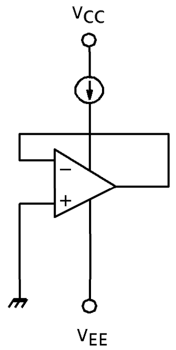
$I_{IO} = |I_{I(-)} - I_{I(+)}|$

(3) CMV_{IN}, CMRR



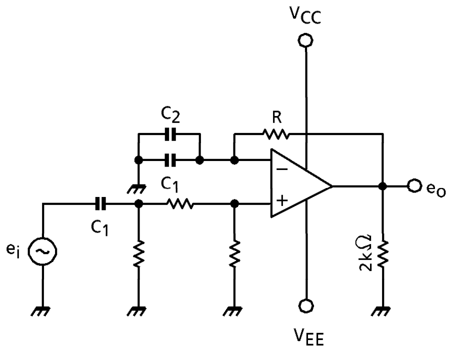
- $CMRR = 20\ell og\ G_D / G_C\ (dB)$
  G_D : DIFFERENTIAL VOLTAGE GAIN
  G_C : COMMON MODE VOLTAGE GAIN
- CMV_{IN} : $V_{IN} = -12V$, 12V SUPPLIES

(4) I_{CC}



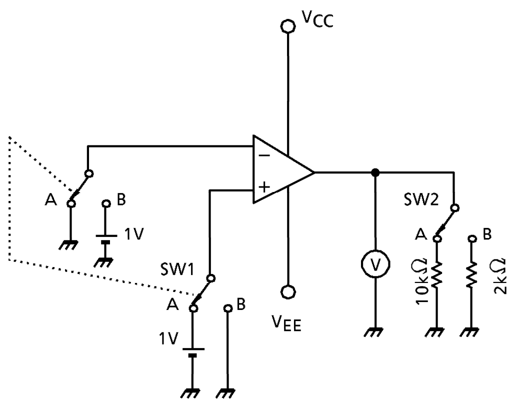
- I_{CC} : V_{CC}, $V_{EE} = \pm 15V$

(5) G_V, f_T



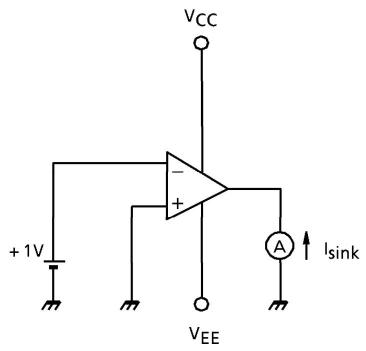
- $G_V = 20\ell og\ e_o / e_i$ (dB)
  $R \gg 1 / W_{C1}$
  C_1 : COUPLING CONDENSER
  C_2 : HIGH FREQUENCY BYPASS CONDENSER
- f_T : INPUT FREQUENCY AT $e_i = e_o$

(6) V_{OM}, V_{OMR}

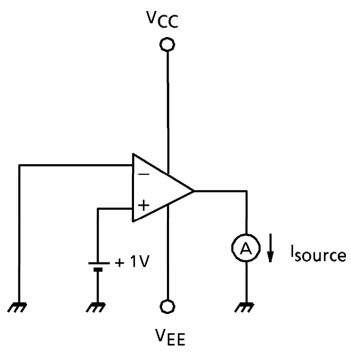


- V_{OM} : (+) : SW1 IS SIDE A, SW2 IS SIDE A
  (−) : SW1 IS SIDE B, SW2 IS SIDE A
- V_{OMR} : (+) : SW1 IS SIDE A, SW2 IS SIDE B
  (−) : SW1 IS SIDE B, SW2 IS SIDE B

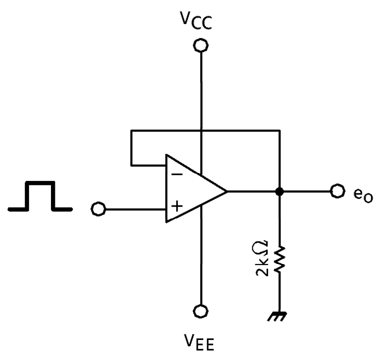
(7) I_{sink}

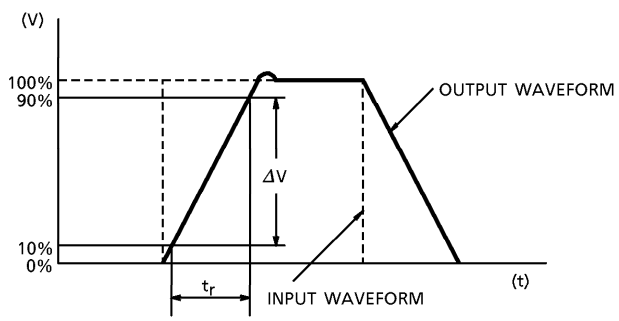


(8) I_{source}



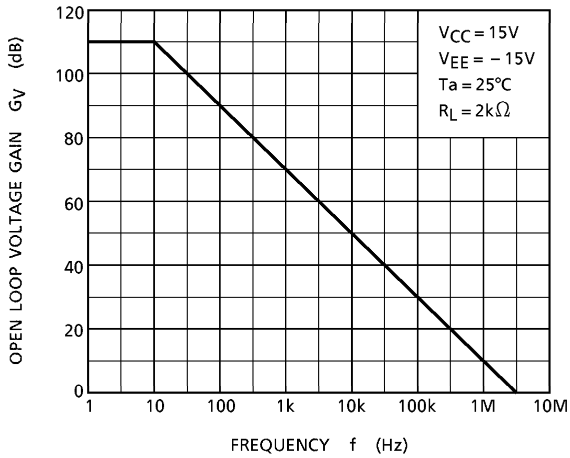
(9) SR



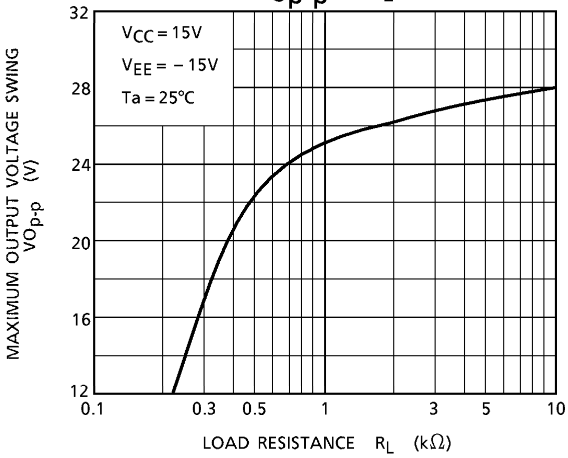


CHARACTERISTIC

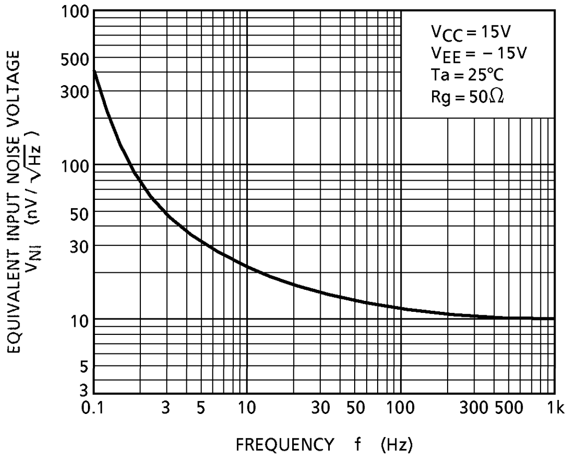
G_V – f



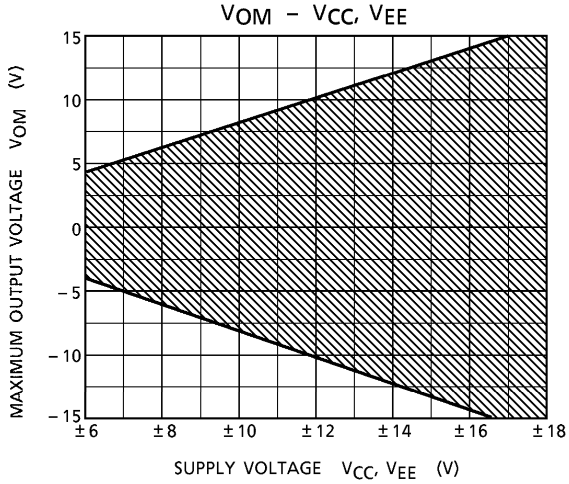
$V_{Op\text{-}p}$ – R_L



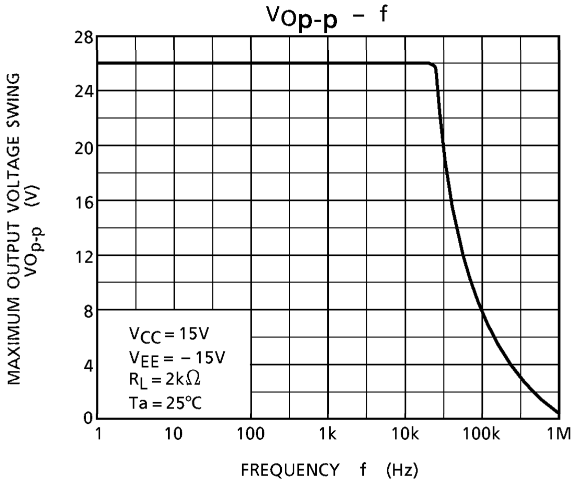
V_{NI} – f



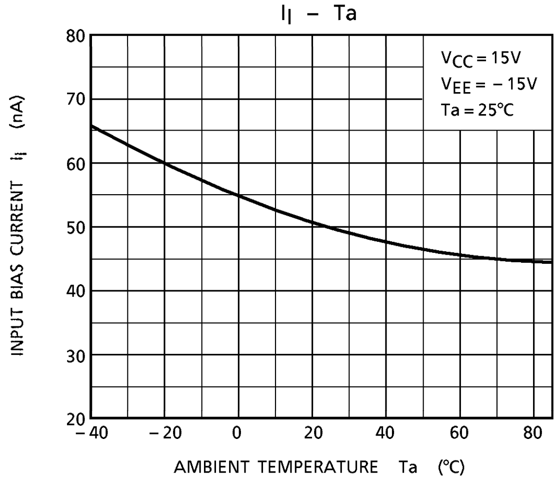
V_{OM} – V_{CC}, V_{EE}

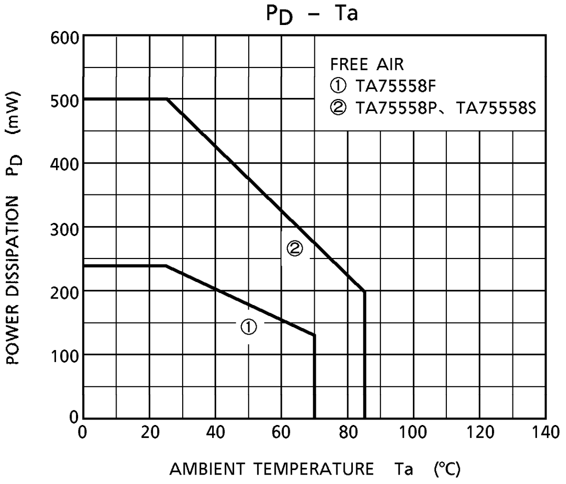


$V_{Op\text{-}p}$ – f



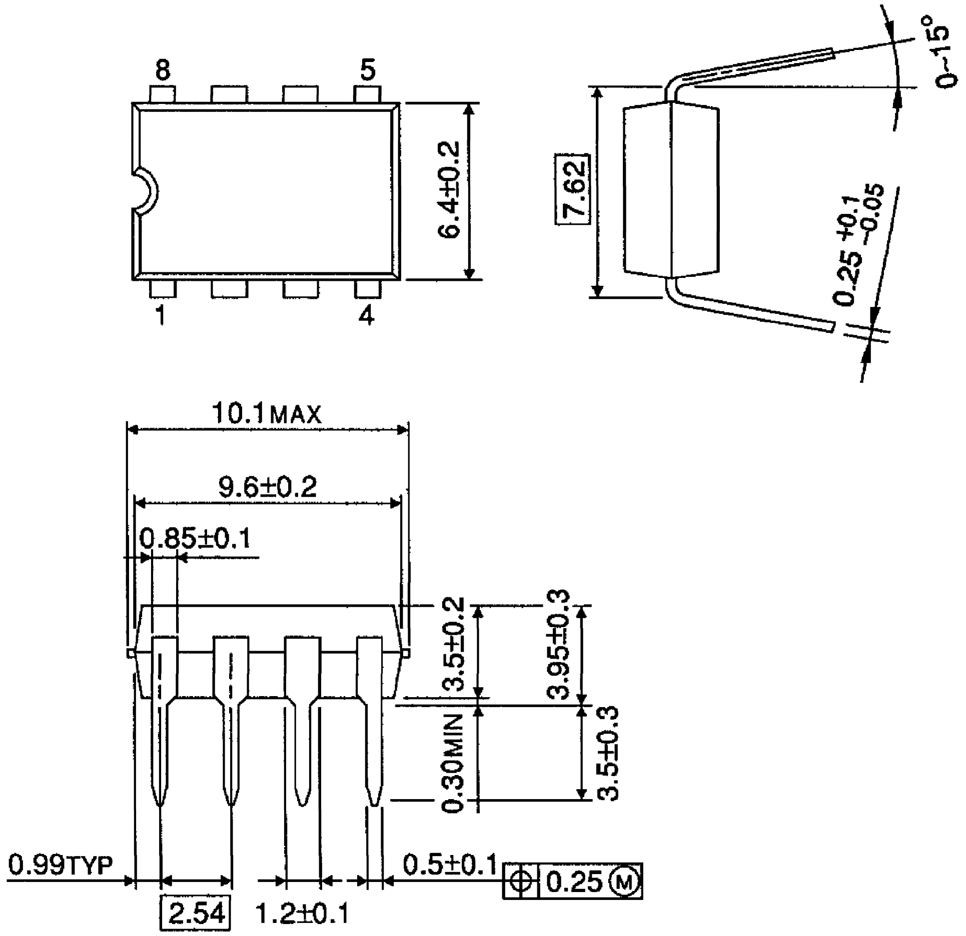
I_I – Ta





PD – Ta
FREE AIR
① TA75558F
② TA75558P、TA75558S
POWER DISSIPATION PD (mW)
AMBIENT TEMPERATURE Ta (°C)
0
100
200
300
400
500
600
0
20
40
60
80
100
120
140
①
②

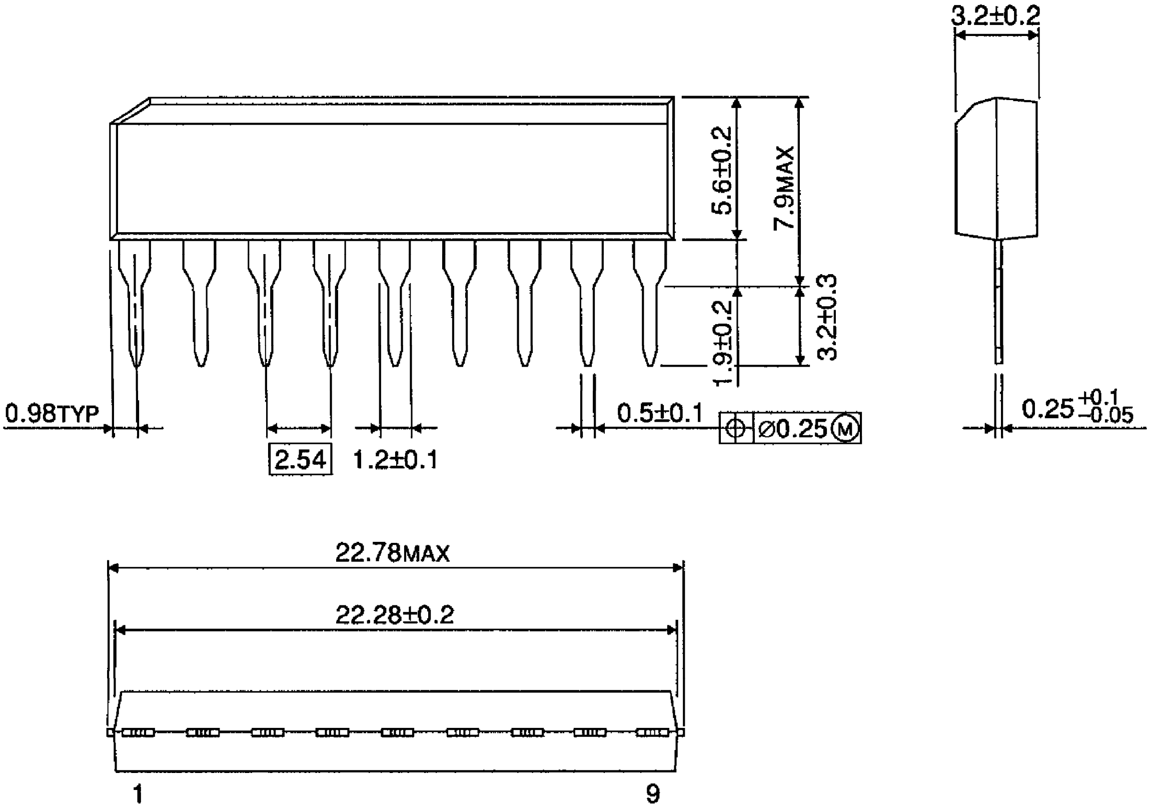
PACKAGE DIMENSIONS
DIP8-P-300-2.54A Unit : mm



Weight : 0.5g (Typ.)

PACKAGE DIMENSIONS
SIP9-P-2.54A

Unit : mm

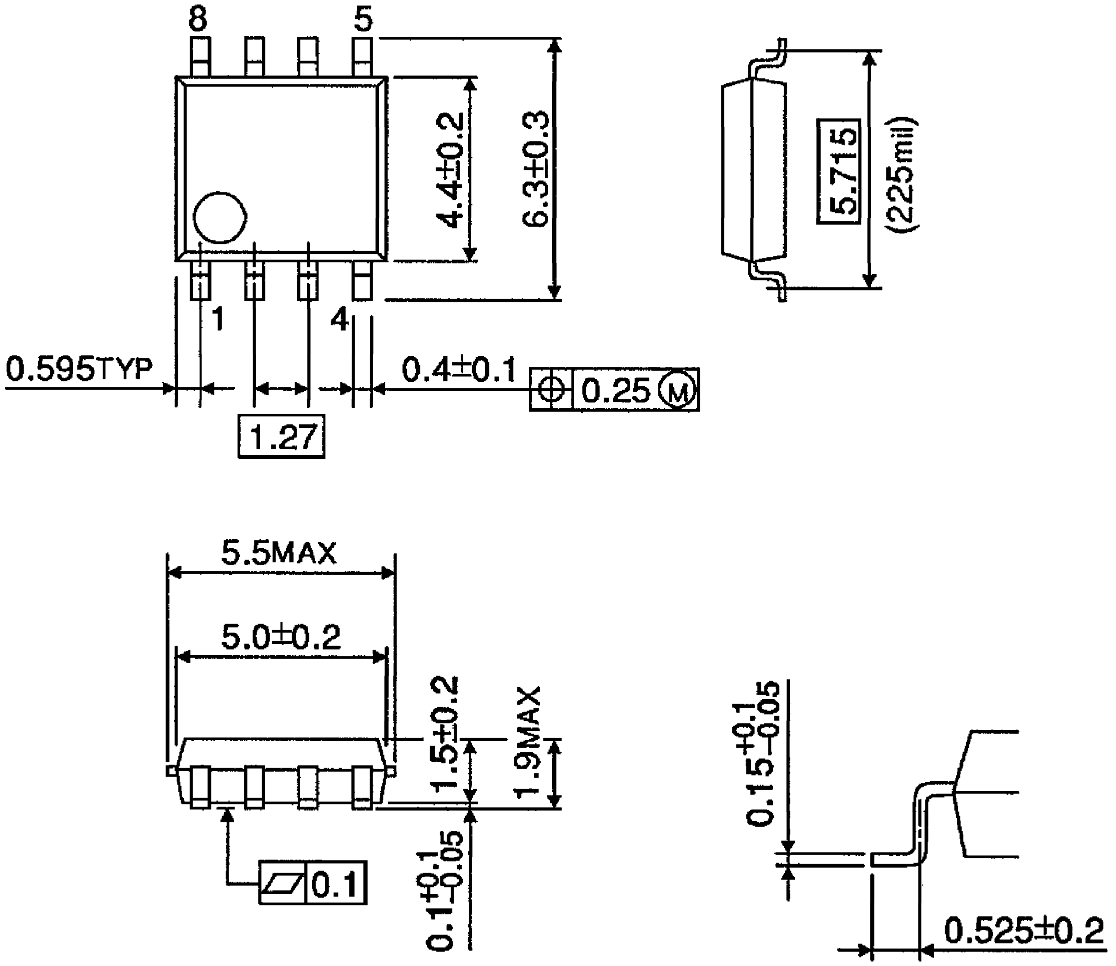


Weight : 0.9g (Typ.)

PACKAGE DIMENSIONS

SOP8-P-225-1.27

Unit : mm



Weight : 0.1g (Typ.)

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000707EBA

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TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

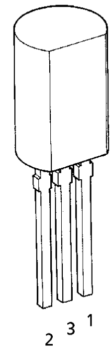
TA78L005AP, TA78L006AP, TA78L007AP, TA78L075AP, TA78L008AP TA78L009AP, TA78L010AP, TA78L012AP, TA78L132AP TA78L015AP, TA78L018AP, TA78L020AP, TA78L024AP

THREE TERMINAL POSITIVE REGULATORS

5 V, 6 V, 7 V, 7.5 V, 8 V, 9 V, 10 V, 12 V, 13.2 V, 15 V, 18 V, 20 V, 24 V

FEATURES

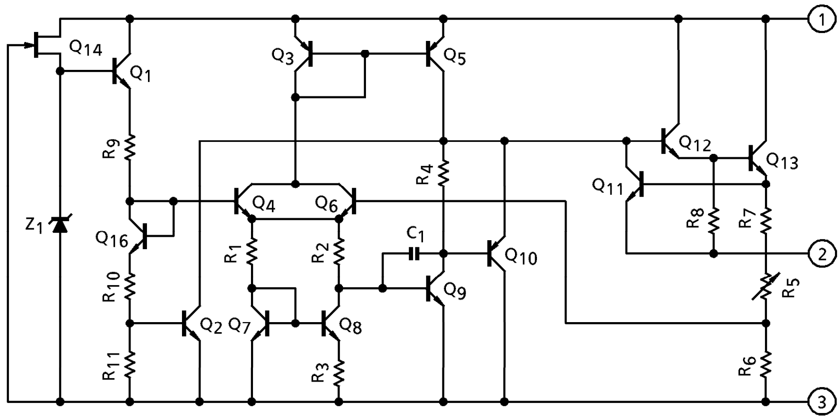
- Suitable for TTL, C²MOS Power Supply
- Internal Short-Circuit Current Limiting
- Internal Thermal Overload Protection
- Maximum Output Current of 150 mA (T_j = 25°C)
- Available in the Plastic TO-92MOD Package



P-SSIP3-1.27

Weight : 0.36 g (Typ.)

EQUIVALENT CIRCUIT



MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Input Voltage	TA78L005AP	V_{IN}	35	V
	TA78L006AP			
	TA78L007AP			
	TA78L075AP			
	TA78L008AP			
	TA78L009AP			
	TA78L010AP			
	TA78L012AP			
	TA78L132AP			
	TA78L015AP			
	TA78L018AP		40	
	TA78L020AP			
	TA78L024AP			
Power Dissipation	(Ta = 25°C)	P_D	800	mW
Operating Temperature		T_{opr}	−30~85	°C
Storage Temperature		T_{stg}	−55~150	°C
Junction Temperature		T_j	150	°C
Thermal Resistance		$R_{th\ (j\text{-}a)}$	156	°C / W

TA78L005AP

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 10 V, I_{OUT} = 40 mA, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, 0°C ≦ T_j ≦ 125°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	1	T_j = 25°C		4.8	5.0	5.2	V
Line Regulation	Reg·line	1	T_j = 25°C	7.0 V ≦ V_{IN} ≦ 20 V	—	55	150	mV
				8.0 V ≦ V_{IN} ≦ 20 V	—	45	100	
Load Regulation	Reg·load	1	T_j = 25°C	1.0 mA ≦ I_{OUT} ≦ 100 mA	—	11	60	mV
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	5.0	30	
Output Voltage	V_{OUT}	1	T_j = 25°C	7.0 V ≦ V_{IN} ≦ 20 V, 1.0 mA ≦ I_{OUT} ≦ 40 mA	4.75	—	5.25	V
				1.0 mA ≦ I_{OUT} ≦ 70 mA	4.75	—	5.25	
Quiescent Current	I_B	1	T_j = 25°C		—	3.1	6.0	mA
			T_j = 125°C		—	—	5.5	
Quiescent Current Change	ΔI_B	1	T_j = 25°C	8.0 V ≦ V_{IN} ≦ 20 V	—	—	1.5	mA
				1.0 mA ≦ IOUT ≦ 40 mA	—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10 Hz ≦ f ≦ 100 kHz		—	40	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—		—	12	—	mV / kh
Ripple Rejection	R.R.	3	f = 120Hz, 8.0 V ≦ V_{IN} ≦ 18 V, T_j = 25°C		41	49	—	dB
Dropout Voltage	V_D	1	T_j = 25°C, I_{OUT} = 150 mA		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5 mA		—	−0.6	—	mV / °C

TA78L006AP

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 11 V, I_{OUT} = 40 mA, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, 0°C ≦ T_j ≦ 125°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	1	T_j = 25°C		5.76	6.0	6.24	V
Line Regulation	Reg·line	1	T_j = 25°C	8.1 V ≦ V_{IN} ≦ 21 V	—	50	150	mV
				9.0 V ≦ V_{IN} ≦ 21 V	—	45	110	
Load Regulation	Reg·load	1	T_j = 25°C	1.0 mA ≦ I_{OUT} ≦ 100 mA	—	12	70	mV
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	5.5	35	
Output Voltage	V_{OUT}	1	T_j = 25°C	8.1 V ≦ V_{IN} ≦ 21 V 1.0 mA ≦ I_{OUT} ≦ 40 mA	5.7	—	6.3	V
				1.0 mA ≦ I_{OUT} ≦ 70 mA	5.7	—	6.3	
Quiescent Current	I_B	1	T_j = 25°C		—	3.1	6.0	mA
			T_j = 125°C		—	—	5.5	
Quiescent Current Change	ΔI_B	1	T_j = 25°C	9.0 V ≦ V_{IN} ≦ 20 V	—	—	1.5	mA
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10 Hz ≦ f ≦ 100 kHz		—	40	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—		—	14	—	mV / kh
Ripple Rejection	R.R.	3	f = 120 Hz, 9.0 V ≦ V_{IN} ≦ 19 V, T_j = 25°C		39	47	—	dB
Dropout Voltage	V_D	1	T_j = 25°C, I_{OUT} = 150 mA		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5mA		—	− 0.7	—	mV / °C

TA78L007AP

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 12 V, I_{OUT} = 40 mA, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, 0°C ≦ T_j ≦ 125°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	1	T_j = 25°C		6.72	7.0	7.28	V
Line Regulation	Reg·line	1	T_j = 25°C	9.2 V ≦ V_{IN} ≦ 22 V	—	50	160	mV
				10 V ≦ V_{IN} ≦ 22 V	—	45	115	
Load Regulation	Reg·load	1	T_j = 25°C	1.0 mA ≦ I_{OUT} ≦ 100 mA	—	13	75	mV
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	6.0	40	
Output Voltage	V_{OUT}	1	T_j = 25°C	9.2 V ≦ V_{IN} ≦ 22 V 1.0 mA ≦ I_{OUT} ≦ 40 mA	6.65	—	7.35	V
				1.0 mA ≦ I_{OUT} ≦ 70 mA	6.65	—	7.35	
Quiescent Current	I_B	1	T_j = 25°C		—	3.1	6.5	mA
			T_j = 125°C		—	—	6.0	
Quiescent Current Change	ΔI_B	1	T_j = 25°C	10 V ≦ V_{IN} ≦ 22 V	—	—	1.5	mA
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10 Hz ≦ f ≦ 100 kHz		—	50	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—		—	17	—	mV / kh
Ripple Rejection	R.R.	3	f = 120 Hz, 10 V ≦ V_{IN} ≦ 20 V, T_j = 25°C		37	46	—	dB
Dropout Voltage	V_D	1	T_j = 25°C, I_{OUT} = 150 mA		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5 mA		—	− 0.75	—	mV / °C

TA78L075AP

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 13 V, I_{OUT} = 40 mA, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, 0°C ≦ T_j ≦ 125°C)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	1	T_j = 25°C		7.21	7.5	7.79	V
Line Regulation	Reg·line	1	T_j = 25°C	9.8 V ≦ V_{IN} ≦ 23 V	—	40	170	mV
				10.5 V ≦ V_{IN} ≦ 23 V	—	40	120	
Load Regulation	Reg·load	1	T_j = 25°C	1.0 mA ≦ I_{OUT} ≦ 100 mA	—	14	80	mV
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	6.5	40	
Output Voltage	V_{OUT}	1	T_j = 25°C	9.8 V ≦ V_{IN} ≦ 23 V, 1.0 mA ≦ I_{OUT} ≦ 40 mA	7.125	—	7.875	V
				1.0 mA ≦ I_{OUT} ≦ 70 mA	7.125	—	7.875	
Quiescent Current	I_B	1	T_j = 25°C		—	3.1	6.5	mA
			T_j = 125°C		—	—	6.0	
Quiescent Current Change	ΔI_B	1	T_j = 25°C	10.5 V ≦ V_{IN} ≦ 23 V	—	—	1.5	mA
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10 Hz ≦ f ≦ 100 kHz		—	60	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—		—	19	—	mV / kh
Ripple Rejection	R.R.	3	f = 120 Hz, 11 V ≦ V_{IN} ≦ 21 V, T_j = 25°C		37	45	—	dB
Dropout Voltage	V_D	1	T_j = 25°C, I_{OUT} = 150 mA		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5 mA		—	−0.75	—	mV / °C

TA78L008AP

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 14 V, I_{OUT} = 40 mA, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, 0°C ≦ T_j ≦ 125°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	1	T_j = 25°C		7.7	8.0	8.3	V
Line Regulation	Reg·line	1	T_j = 25°C	10.5 V ≦ V_{IN} ≦ 23 V	—	20	175	mV
				11 V ≦ V_{IN} ≦ 23 V	—	12	125	
Load Regulation	Reg·load	1	T_j = 25°C	1.0 mA ≦ I_{OUT} ≦ 100 mA	—	15	80	mV
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	7.0	40	
Output Voltage	V_{OUT}	1	T_j = 25°C	10.5 V ≦ V_{IN} ≦ 23 V, 1.0 mA ≦ I_{OUT} ≦ 40 mA	7.6	—	8.4	V
				1.0 mA ≦ I_{OUT} ≦ 70 mA	7.6	—	8.4	
Quiescent Current	I_B	1	T_j = 25°C		—	3.1	6.5	mA
			T_j = 125°C		—	—	6.0	
Quiescent Current Change	ΔI_B	1	T_j = 25°C	11 V ≦ V_{IN} ≦ 23 V	—	—	1.5	mA
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10 Hz ≦ f ≦ 100 kHz		—	60	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT}/\Delta t$	1	—		—	20	—	mV / kh
Ripple Rejection	R.R.	3	f = 120 Hz, 12 V ≦ V_{IN} ≦ 23 V, T_j = 25°C		37	45	—	dB
Dropout Voltage	V_D	1	T_j = 25°C, I_{OUT} = 150 mA		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5 mA		—	− 0.8	—	mV / °C

TA78L009AP

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 15 V, I_{OUT} = 40 mA, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, 0°C ≦ T_j ≦ 125°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	1	T_j = 25°C		8.64	9.0	9.36	V
Line Regulation	Reg·line	1	T_j = 25°C	11.4 V ≦ V_{IN} ≦ 24 V	—	80	200	mV
				12 V ≦ V_{IN} ≦ 24 V	—	20	160	
Load Regulation	Reg·load	1	T_j = 25°C	1.0 mA ≦ I_{OUT} ≦ 100 mA	—	17	90	mV
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	8.0	45	
Output Voltage	V_{OUT}	1	T_j = 25°C	11.4 V ≦ V_{IN} ≦ 24 V, 1.0 mA ≦ I_{OUT} ≦ 40 mA	8.55	—	9.45	V
				1.0 mA ≦ I_{OUT} ≦ 70 mA	8.55	—	9.45	
Quiescent Current	I_B	1	T_j = 25°C		—	3.2	6.5	mA
			T_j = 125°C		—	—	6.0	
Quiescent Current Change	ΔI_B	1	T_j = 25°C	12 V ≦ V_{IN} ≦ 24 V	—	—	1.5	mA
				1.0 mA ≦ I_{OUT} ≦ 40mA	—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10 Hz ≦ f ≦ 100 kHz		—	65	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—		—	21	—	mV / kh
Ripple Rejection	R.R.	3	f = 120 Hz, 12 V ≦ V_{IN} ≦ 24 V, T_j = 25°C		36	44	—	dB
Dropout Voltage	V_D	1	T_j = 25°C, I_{OUT} = 150 mA		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5 mA		—	−0.85	—	mV / °C

TA78L010AP

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 16 V, I_{OUT} = 40 mA, C_{IN} = 0.33 μF, C_{OUT} = 0.1μF, 0°C ≦ T_j ≦ 125°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	1	T_j = 25°C		9.6	10	10.4	V
Line Regulation	Reg·line	1	T_j = 25°C	12.5 V ≦ V_{IN} ≦ 25 V	—	80	230	mV
				13 V ≦ V_{IN} ≦ 25 V	—	30	170	
Load Regulation	Reg·load	1	T_j = 25°C	1.0 mA ≦ I_{OUT} ≦ 100 mA	—	18	90	mV
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	8.5	45	
Output Voltage	V_{OUT}	1	T_j = 25°C	12.5 V ≦ V_{IN} ≦ 25 V, 1.0 mA ≦ I_{OUT} ≦ 40 mA	9.5	—	10.5	V
				1.0 mA ≦ I_{OUT} ≦ 70 mA	9.5	—	10.5	
Quiescent Current	I_B	1	T_j = 25°C		—	3.2	6.5	mA
			T_j = 125°C		—	—	6.0	
Quiescent Current Change	ΔI_B	1	T_j = 25°C	13 V ≦ V_{IN} ≦ 25 V	—	—	1.5	mA
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10 Hz ≦ f ≦ 100 kHz		—	70	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—		—	22	—	mV / kh
Ripple Rejection	R.R.	3	f = 120 Hz, 13 V ≦ V_{IN} ≦ 24 V, T_j = 25°C		36	43	—	dB
Dropout Voltage	V_D	1	T_j = 25°C, I_{OUT} = 150 mA		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5 mA		—	− 0.9	—	mV / °C

TA78L012AP

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 19 V, I_{OUT} = 40 mA, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, 0°C ≦ T_j ≦ 125°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	1	T_j = 25°C		11.5	12	12.5	V
Line Regulation	Reg·line	1	T_j = 25°C	14.5 V ≦ V_{IN} ≦ 27 V	—	120	250	mV
				16 V ≦ V_{IN} ≦ 27 V	—	100	200	
Load Regulation	Reg·load	1	T_j = 25°C	1.0 mA ≦ I_{OUT} ≦ 100 mA	—	20	100	mV
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	10	50	
Output Voltage	V_{OUT}	1	T_j = 25°C	14.5 V ≦ V_{IN} ≦ 27 V, 1.0 mA ≦ I_{OUT} ≦ 40 mA	11.4	—	12.6	V
				1.0 mA ≦ I_{OUT} ≦ 70 mA	11.4	—	12.6	
Quiescent Current	I_B	1	T_j = 25°C		—	3.2	6.5	mA
			T_j = 125°C		—	—	6.0	
Quiescent Current Change	ΔI_B	1	T_j = 25°C	16 V ≦ V_{IN} ≦ 27 V	—	—	1.5	mA
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10 Hz ≦ f ≦ 100 kHz		—	80	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—		—	24	—	mV / kh
Ripple Rejection	R.R.	3	f = 120 Hz, 15 V ≦ V_{IN} ≦ 25 V, T_j = 25°C		36	41	—	dB
Dropout Voltage	V_D	1	T_j = 25°C, I_{OUT} = 150 mA		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5 mA		—	– 1.0	—	mV / °C

TA78L132AP

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 21 V, I_{OUT} = 40 mA, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, 0°C ≦ T_j ≦ 125°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	1	T_j = 25°C		12.67	13.2	13.73	V
Line Regulation	Reg·line	1	T_j = 25°C	16 V ≦ V_{IN} ≦ 28 V	—	125	270	mV
				17 V ≦ V_{IN} ≦ 28 V	—	105	225	
Load Regulation	Reg·load	1	T_j = 25°C	1.0 mA ≦ I_{OUT} ≦ 100 mA	—	22	120	mV
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	11	60	
Output Voltage	V_{OUT}	1	T_j = 25°C	16 V ≦ V_{IN} ≦ 28 V, 1.0 mA ≦ I_{OUT} ≦ 40 mA	12.54	—	13.86	V
				1.0 mA ≦ I_{OUT} ≦ 70 mA	12.54	—	13.86	
Quiescent Current	I_B	1	T_j = 25°C		—	3.2	6.5	mA
			T_j = 125°C		—	—	6.0	
Quiescent Current Change	ΔI_B	1	T_j = 25°C	17 V ≦ V_{IN} ≦ 28 V	—	—	1.5	mA
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10 Hz ≦ f ≦ 100 kHz		—	90	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—		—	28	—	mV / kh
Ripple Rejection	R.R.	3	f = 120 Hz, 17 V ≦ V_{IN} ≦ 27 V, T_j = 25°C		34	41	—	dB
Dropout Voltage	V_D	1	T_j = 25°C, I_{OUT} = 150 mA		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5 mA		—	− 1.2	—	mV / °C

TA78L015AP

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 23 V, I_{OUT} = 40 mA, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, 0°C ≦ T_j ≦ 125°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	1	T_j = 25°C		14.4	15	15.6	V
Line Regulation	Reg·line	1	T_j = 25°C	17.5 V ≦ V_{IN} ≦ 30 V	—	130	300	mV
				20 V ≦ V_{IN} ≦ 30 V	—	110	250	
Load Regulation	Reg·load	1	T_j = 25°C	1.0 mA ≦ I_{OUT} ≦ 100 mA	—	25	150	mV
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	12	75	
Output Voltage	V_{OUT}	1	T_j = 25°C	17.5 V ≦ V_{IN} ≦ 30 V, 1.0 mA ≦ I_{OUT} ≦ 40 mA	14.25	—	15.75	V
				1.0 mA ≦ I_{OUT} ≦ 70 mA	14.25	—	15.75	
Quiescent Current	I_B	1	T_j = 25°C		—	3.3	6.5	mA
			T_j = 125°C		—	—	6.0	
Quiescent Current Change	ΔI_B	1	T_j = 25°C	20 V ≦ V_{IN} ≦ 30 V	—	—	1.5	mA
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10 Hz ≦ f ≦ 100 kHz		—	90	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—		—	30	—	mV / kh
Ripple Rejection	R.R.	3	f = 120 Hz, 18.5 V ≦ V_{IN} ≦ 28.5 V, T_j = 25°C		34	40	—	dB
Dropout Voltage	V_D	1	T_j = 25°C, I_{OUT} = 150 mA		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5 mA		—	– 1.3	—	mV / °C

TA78L018AP

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 27 V, I_{OUT} = 40 mA, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, 0°C ≦ T_j ≦ 125°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	1	T_j = 25°C		17.3	18	18.7	V
Line Regulation	Reg·line	1	T_j = 25°C	21.4 V ≦ V_{IN} ≦ 33 V	—	32	325	mV
				22 V ≦ V_{IN} ≦ 33 V	—	27	275	
Load Regulation	Reg·load	1	T_j = 25°C	1.0 mA ≦ I_{OUT} ≦ 100 mA	—	30	170	mV
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	15	75	
Output Voltage	V_{OUT}	1	T_j = 25°C	21.4 V ≦ V_{IN} ≦ 33 V, 1.0 mA ≦ I_{OUT} ≦ 40 mA	17.1	—	18.9	V
				1.0 mA ≦ I_{OUT} ≦ 70 mA	17.1	—	18.9	
Quiescent Current	I_B	1	T_j = 25°C		—	3.3	6.5	mA
			T_j = 125°C		—	—	6.0	
Quiescent Current Change	ΔI_B	1	T_j = 25°C	22 V ≦ V_{IN} ≦ 33 V	—	—	1.5	mA
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10 Hz ≦ f ≦ 100 kHz		—	150	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—		—	45	—	mV / kh
Ripple Rejection	R.R.	3	f = 120 Hz, 23 V ≦ V_{IN} ≦ 33 V, T_j = 25°C		32	38	—	dB
Dropout Voltage	V_D	1	T_j = 25°C, I_{OUT} = 150 mA		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5 mA		—	− 1.5	—	mV / °C

TA78L020AP

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 29 V, I_{OUT} = 40 mA, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, 0°C ≦ T_j ≦ 125°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	1	T_j = 25°C		19.2	20	20.8	V
Line Regulation	Reg·line	1	T_j = 25°C	23.5 V ≦ V_{IN} ≦ 35 V	—	33	330	mV
				24 V ≦ V_{IN} ≦ 35 V	—	28	285	
Load Regulation	Reg·load	1	T_j = 25°C	1.0 mA ≦ I_{OUT} ≦ 100 mA	—	33	180	mV
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	17	90	
Output Voltage	V_{OUT}	1	T_j = 25°C	23.5 V ≦ V_{IN} ≦ 35 V, 1.0 mA ≦ I_{OUT} ≦ 40 mA	19.0	—	21.0	V
				1.0 mA ≦ I_{OUT} ≦ 70mA	19.0	—	21.0	
Quiescent Current	I_B	1	T_j = 25°C		—	3.3	6.5	mA
			T_j = 125°C		—	—	6.0	
Quiescent Current Change	ΔI_B	1	T_j = 25°C	24 V ≦ V_{IN} ≦ 35 V	—	—	1.5	mA
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10 Hz ≦ f ≦ 100 kHz		—	170	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—		—	49	—	mV / kh
Ripple Rejection	R.R.	3	f = 120 Hz, 25 V ≦ V_{IN} ≦ 35 V, T_j = 25°C		31	37	—	dB
Dropout Voltage	V_D	1	T_j = 25°C, I_{OUT} = 150 mA		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5 mA		—	– 1.7	—	mV / °C

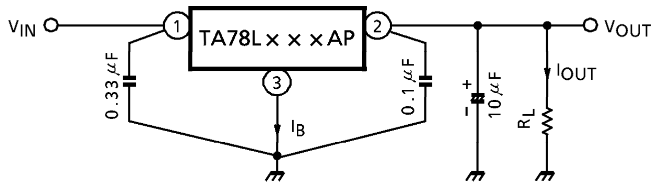
TA78L024AP

ELECTRICAL CHARACTERISTICS

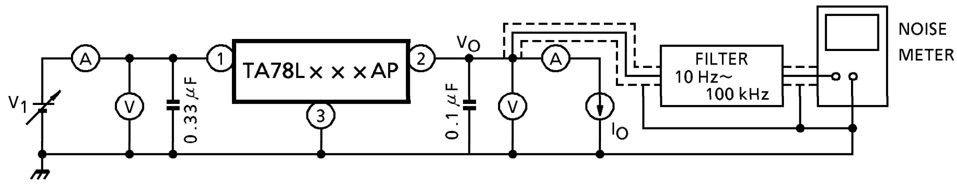
(Unless otherwise specified, V_{IN} = 33 V, I_{OUT} = 40 mA, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, 0°C ≦ T_j ≦ 125°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	1	T_j = 25°C		23	24	25	V
Line Regulation	Reg·line	1	T_j = 25°C	27.5 V ≦ V_{IN} ≦ 38 V	—	35	350	mV
				28 V ≦ V_{IN} ≦ 38 V	—	30	300	
Load Regulation	Reg·load	1	T_j = 25°C	1.0 mA ≦ I_{OUT} ≦ 100 mA	—	40	200	mV
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	20	100	
Output Voltage	V_{OUT}	1	T_j = 25°C	27.5 V ≦ V_{IN} ≦ 38 V, 1.0 mA ≦ I_{OUT} ≦ 40 mA	22.8	—	25.2	V
				1.0 mA ≦ I_{OUT} ≦ 70mA	22.8	—	25.2	
Quiescent Current	I_B	1	T_j = 25°C		—	3.5	6.5	mA
			T_j = 125°C		—	—	6.0	
Quiescent Current Change	ΔI_B	1	T_j = 25°C	28 V ≦ V_{IN} ≦ 38 V	—	—	1.5	mA
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10 Hz ≦ f ≦ 100 kHz		—	200	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—		—	56	—	mV / kh
Ripple Rejection	R.R.	3	f = 120 Hz, 29 V ≦ V_{IN} ≦ 39 V, T_j = 25°C		31	35	—	dB
Dropout Voltage	V_D	1	T_j = 25°C, I_{OUT} = 150 mA		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5 mA		—	– 2.0	—	mV / °C

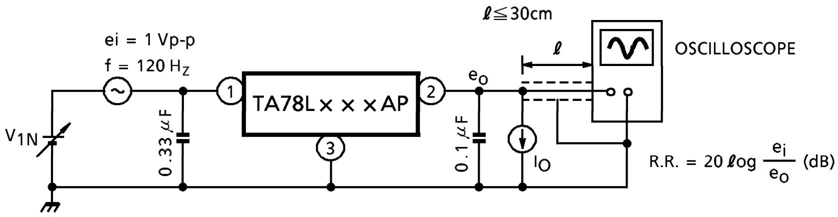
TEST CIRCUIT 1 / STANDARD APPLICATION

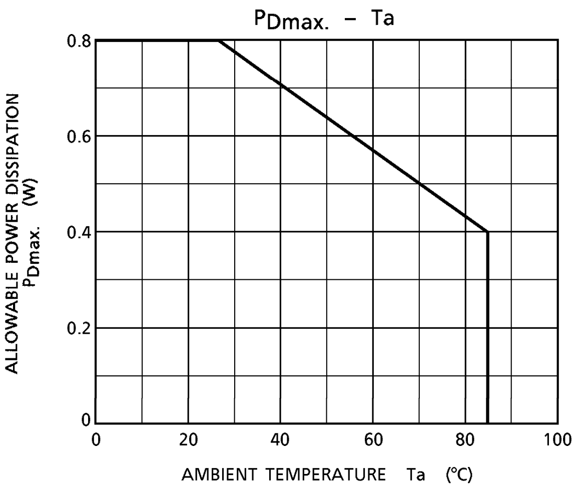


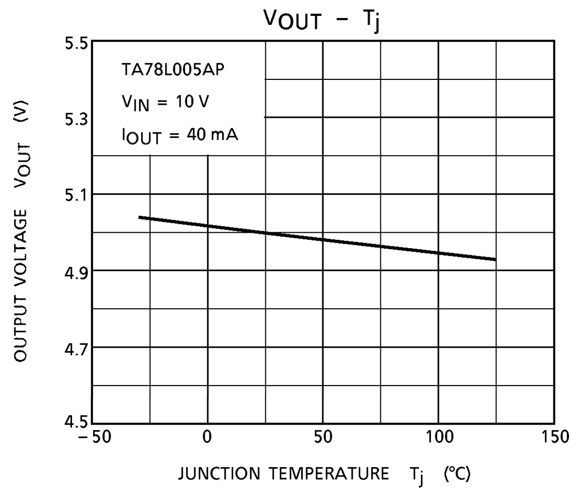
TEST CIRCUIT 2 V_{NO}

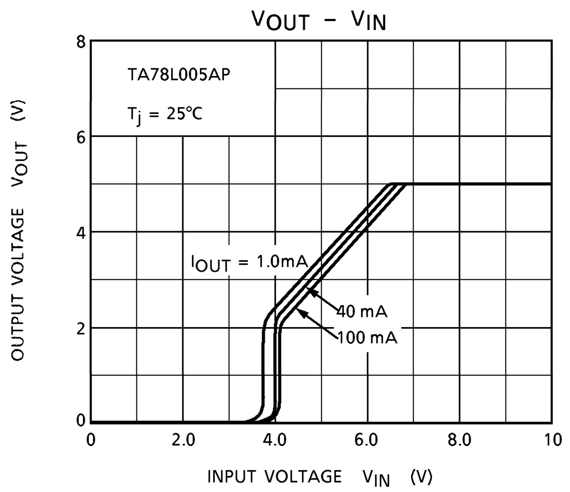


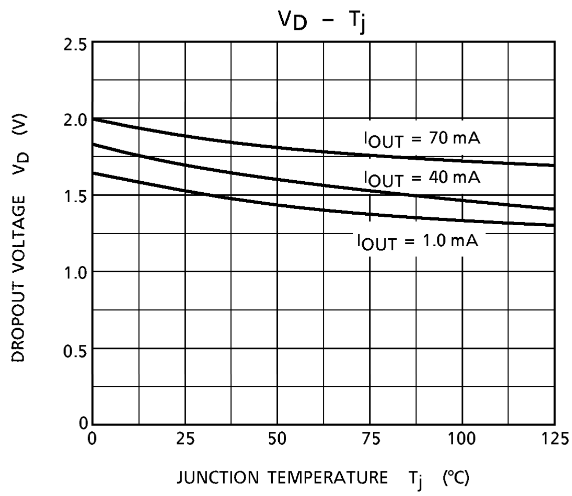
TEST CIRCUIT 3 R.R.

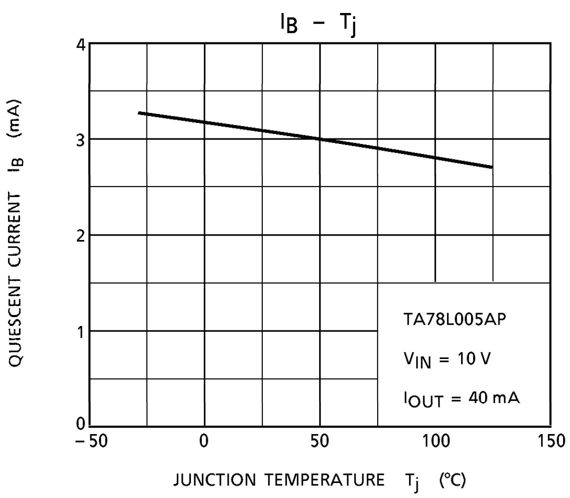


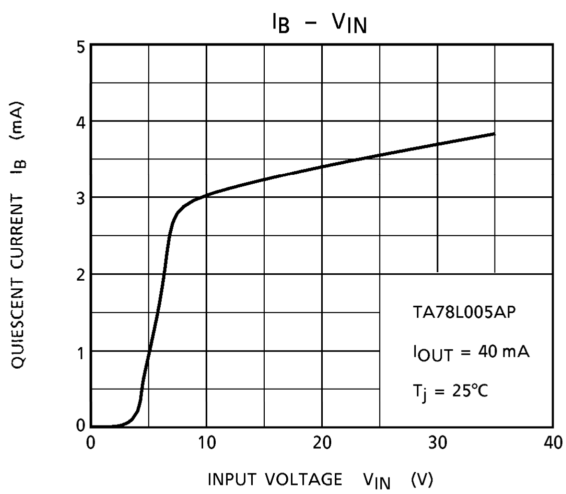

PDmax. – Ta
ALLOWABLE POWER DISSIPATION PDmax. (W)
AMBIENT TEMPERATURE Ta (°C)
0.8
0.6
0.4
0.2
0
0 20 40 60 80 100

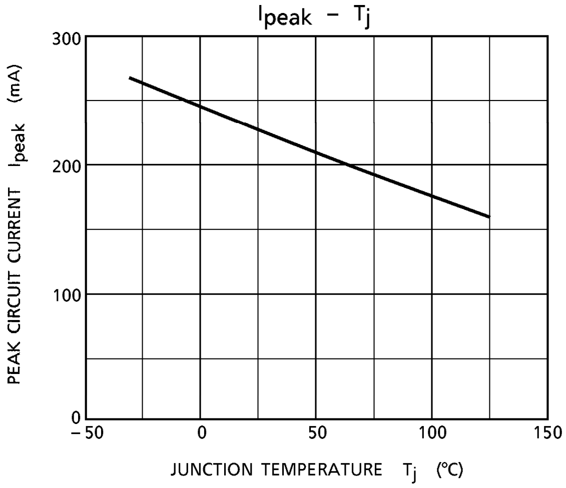

VOUT – Tj
TA78L005AP
VIN = 10 V
IOUT = 40 mA
OUTPUT VOLTAGE VOUT (V)
JUNCTION TEMPERATURE Tj (°C)
5.5 5.3 5.1 4.9 4.7 4.5
−50 0 50 100 150

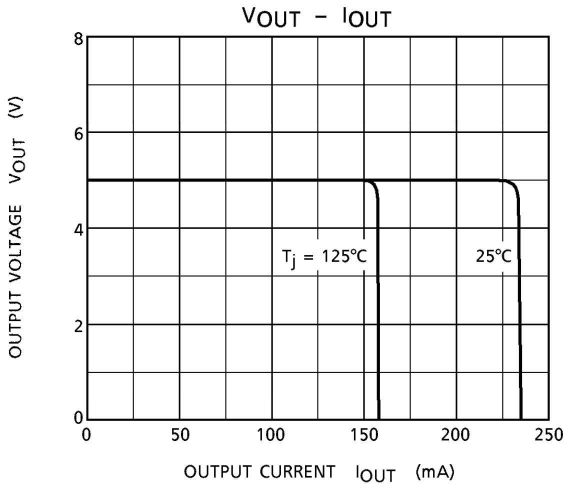

VOUT – VIN
TA78L005AP
Tj = 25°C
IOUT = 1.0mA
40 mA
100 mA
OUTPUT VOLTAGE VOUT (V)
INPUT VOLTAGE VIN (V)
8 6 4 2 0
0 2.0 4.0 6.0 8.0 10


VD – Tj
IOUT = 70 mA
IOUT = 40 mA
IOUT = 1.0 mA
DROPOUT VOLTAGE VD (V)
JUNCTION TEMPERATURE Tj (°C)
2.5 2.0 1.5 1.0 0.5 0
0 25 50 75 100 125


IB – Tj
TA78L005AP
VIN = 10 V
IOUT = 40 mA
QUIESCENT CURRENT IB (mA)
JUNCTION TEMPERATURE Tj (°C)
4 3 2 1 0
−50 0 50 100 150


IB – VIN
TA78L005AP
IOUT = 40 mA
Tj = 25°C
QUIESCENT CURRENT IB (mA)
INPUT VOLTAGE VIN (V)
5 4 3 2 1 0
0 10 20 30 40


Ipeak – Tj
PEAK CIRCUIT CURRENT Ipeak (mA)
300
200
100
0
– 50
0
50
100
150
JUNCTION TEMPERATURE Tj (°C)

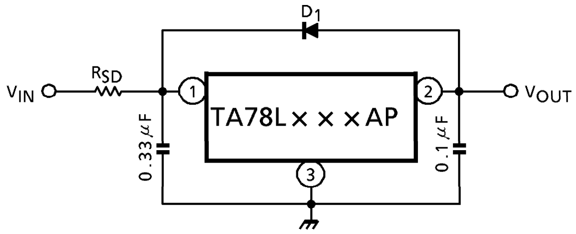

VOUT – IOUT
OUTPUT VOLTAGE VOUT (V)
8
6
4
2
0
Tj = 125°C
25°C
0
50
100
150
200
250
OUTPUT CURRENT IOUT (mA)

Precautions for Use

If high voltage in excess of output voltage (TYP. value) of IC is applied to its output terminal, IC may be destroyed. In this case, connect a Zener diode between the output terminal and GND to prevent application of excessive voltage. In particular, in such a current boosting circuit as shown in Application Circuit Example (2), if input voltage is suddenly applied by stages and furthermore, load is light, excessive voltage may be applied transiently to the output terminal of IC. In such a case as this, it may become necessary to increase capacity of output capacitor as appropriate, use a smaller R_1 (a resistor for bypassing IC bias current) or gradually rise input voltage in addition to use of a Zener diode as mentioned above.

APPLICATION CIRCUIT

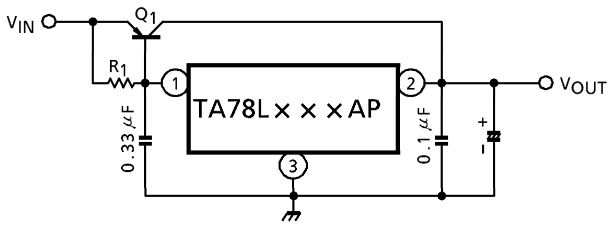
(1) STANDARD APPLICATION



D_1 : IC protective diode
When surge voltage is applied to IC output terminal or $V_{IN} < V_{OUT}$ at the time of power ON / OFF, always connect the high speed swithing diode D_1.

R_{SD} : Power limiting resistor
If V_{IN} is too high, always connect R_{SD} in order to reduce power consumption of IC.

(2) A. CURRENT BOOST VOLTAGE REGULATOR

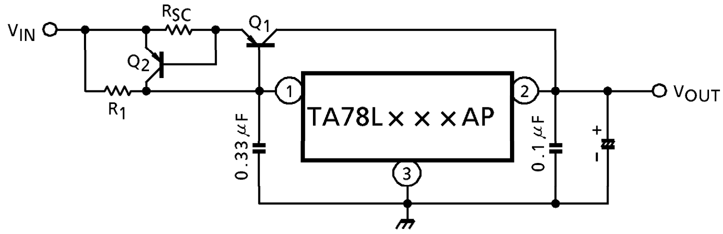


Use a required rediation plate for Q_1.

$$R_1 \leq \frac{V_{BE1}}{I_B\ MAX}$$

where, V_{BE1} : V_{BE} of external transistor Q_1.
I_B MAX : Max. bias current of IC.

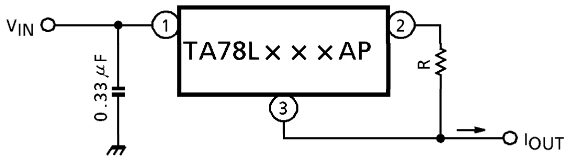
B. SHORT-CIRCUIT PROTECTION



$$R_{SC} = \frac{V_{BE2}}{I_{SC}}$$

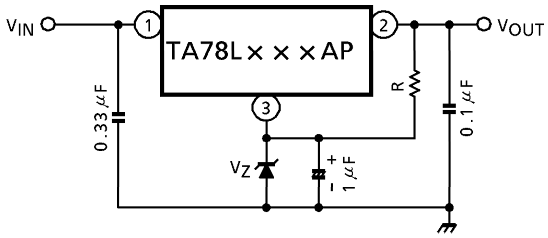
where, I_{SC} : Short-Circuit current

(3) CURRENT REGULATOR

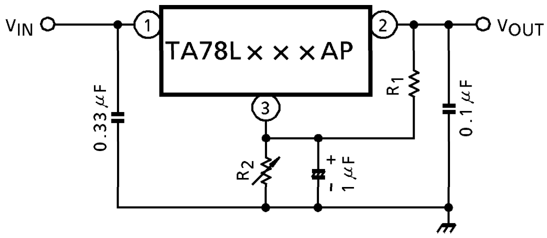


$I_{OUT} = \frac{V_{OUT}}{R} + I_B$

(4) VOLTAGE BOOST REGULATOR

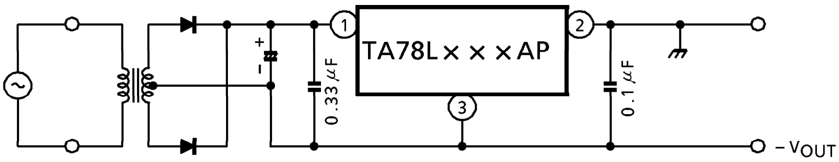


$V_{OUT} = V_Z + V_{OUT}$ (of IC)
A little of current in resistor R is needed.

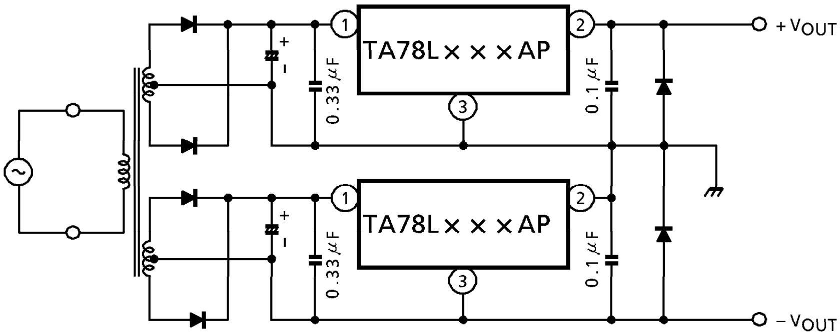


$V_{OUT} = R_2 \left(I_B \cdot \frac{V_{OUT}\text{(of IC)}}{R_1}\right) + V_{OUT}\text{(of IC)}$

(5) NEGATIVE REGULATOR



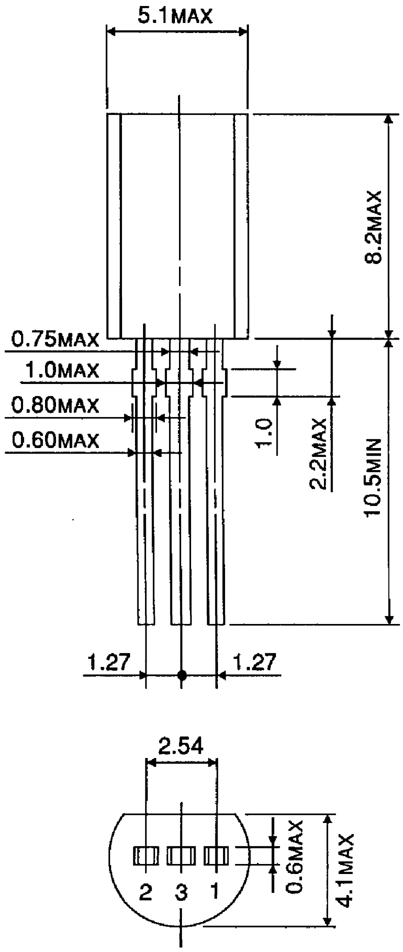
(6) POSITIVE AND NEGATIVE REGULATOR



PACKAGE DIMENSIONS

P-SSIP3-1.27

Unit : mm



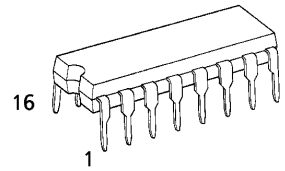
Weight : 0.36g (Typ.)

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

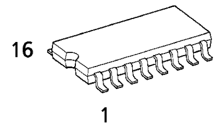
TC4017BP, TC4017BF

TC4017BP / TC4017BF DECADE COUNTER / DIVIDER

TC4017BP / BF is decimal Johnson counter consisting of 5 stage D-type flip-flop equipped with the decoder to convert the output to decimal.
Depending on the number of count pulses fed to CLOCK or CLOCK INHIBIT one output among 10 output lines " Q0 " through " Q9 " becomes " H " level.
The counter advances its state at rising edge of CLOCK (CLOCK IHIBIT = " L ") or falling edge of CLOCK INHIBIT (CLOCK = " H "). RESET input to " H " level resets the counter to Q0 = " H " and Q1 through Q9 = " L " regardless of CLOCK and CLOCK INHIBIT.



P (DIP16-P-300-2.54A)
Weight : 1.00g (Typ.)

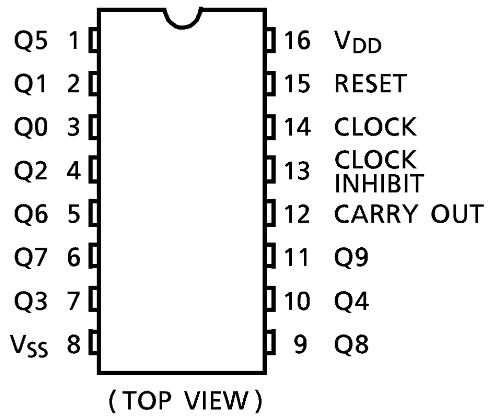


F (SOP16-P-300-1.27)
Weight : 0.18g (Typ.)

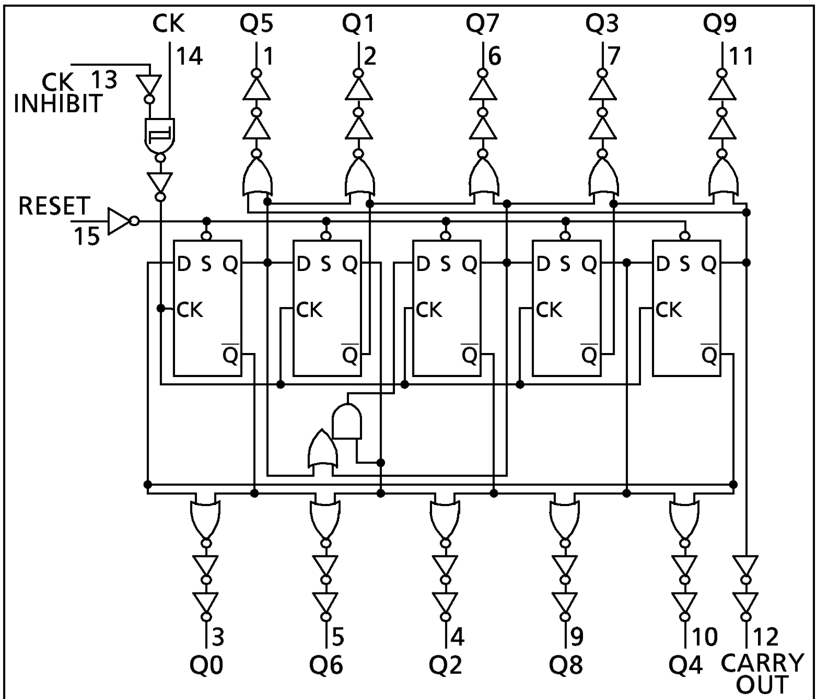
MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
DC Supply Voltage	V_{DD}	$V_{SS}-0.5\sim V_{SS}+20$	V
Input Voltage	V_{IN}	$V_{SS}-0.5\sim V_{DD}+0.5$	V
Output Voltage	V_{OUT}	$V_{SS}-0.5\sim V_{DD}+0.5$	V
DC Input Current	I_{IN}	±10	mA
Power Dissipation	P_D	300 (DIP) / 180 (SOIC)	mW
Operating Ambient Temperature Range	T_{opr}	−40~85	°C
Storage Temperature Range	T_{stg}	−65~150	°C

PIN ASSIGNMENT



LOGIC DIAGRAM

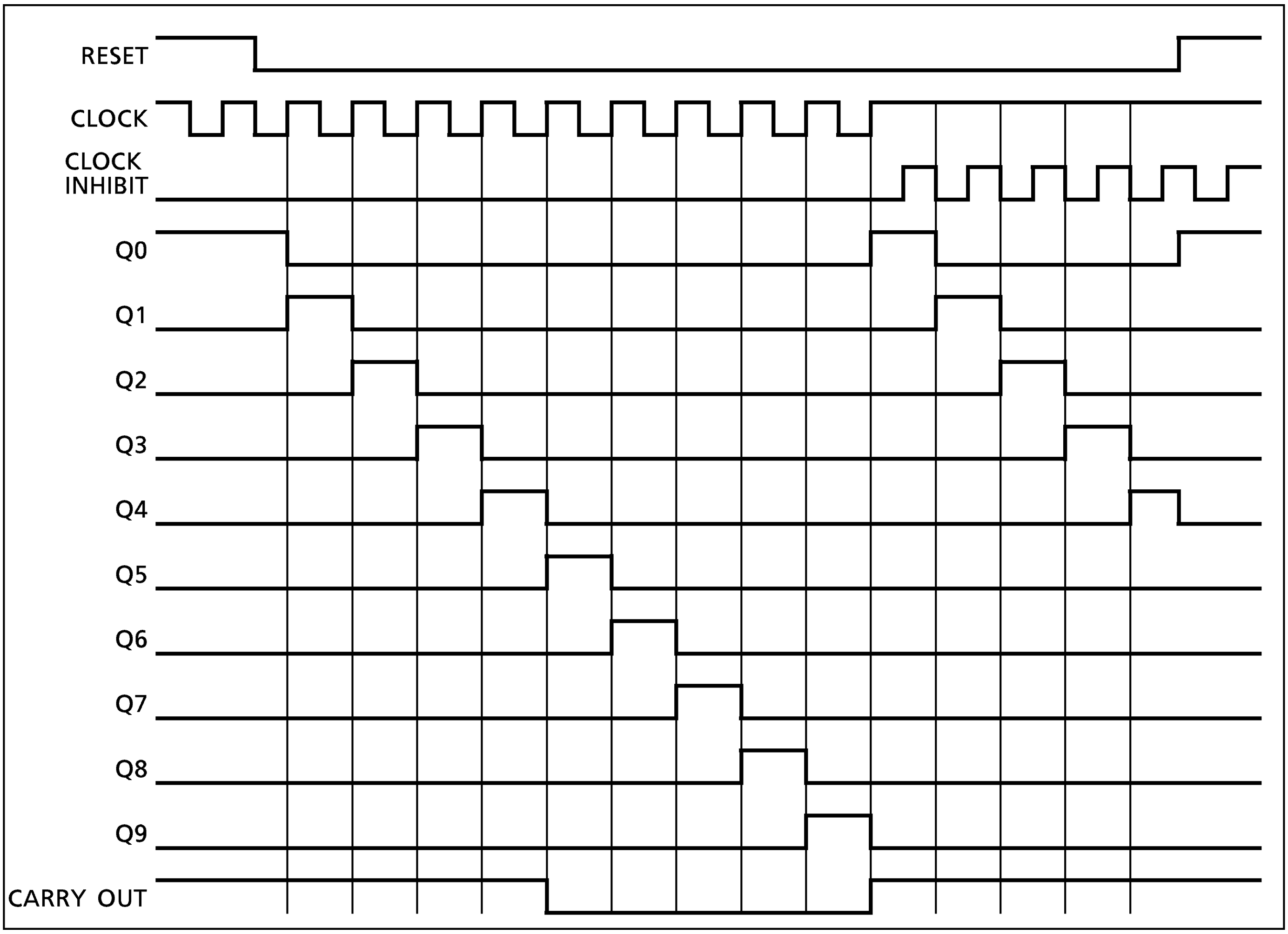


TRUTH TABLE

INPUTS			SELECTED OUTPUT
CLOCK△	CLOCK INHIBIT△	RESET	
※	※	H	Q0
※	H	L	Qn (NC)
L	※	L	Qn (NC)
↑	L	L	Qn + 1
↓	L	L	Qn (NC)
H	↑	L	Qn (NC)
H	↓	L	Qn + 1

△ ; Level Change
※ ; Don't Care
NC ; No Change
CARRY OUT { " H " ····· Q0 ~ Q4 = "H" ; " L " ····· Q5 ~ Q9 = "H" }

TIMING CHART



RECOMMENDED OPERATING CONDITIONS (V_{SS} = 0V)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
DC Supply Voltage	V_{DD}		3	—	18	V
Input Voltage	V_{IN}		0	—	V_{DD}	V

STATIC ELECTRICAL CHARACTERISTICS (V_{SS} = 0V)

CHARACTERISTIC	SYM-BOL	TEST CONDITION	V_{DD} (V)	−40°C MIN.	−40°C MAX.	25°C MIN.	25°C MIN.	25°C MAX.	85°C MIN.	85°C MAX.	UNIT
High-Level Output Voltage	V_{OH}	$\|I_{OUT}\| < 1\mu A$ $V_{IN} = V_{SS}, V_{DD}$	5	4.95	—	4.95	5.00	—	4.95	—	V
			10	9.95	—	9.95	10.00	—	9.95	—	
			15	14.95	—	14.95	15.00	—	14.95	—	
Low-Level Output Voltage	V_{OL}	$\|I_{OUT}\| < 1\mu A$ $V_{IN} = V_{SS}, V_{DD}$	5	—	0.05	—	0.00	0.05	—	0.05	
			10	—	0.05	—	0.00	0.05	—	0.05	
			15	—	0.05	—	0.00	0.05	—	0.05	

STATIC ELECTRICAL CHARACTERISTICS (V_{SS} = 0V)

CHARACTERISTIC		SYM-BOL	TEST CONDITION	V_{DD} (V)	−40°C MIN.	−40°C MAX.	25°C MIN.	25°C TYP.	25°C MAX.	85°C MIN.	85°C MAX.	UNIT
Output High Current		I_{OH}	V_{OH} = 4.6V	5	−0.61	—	−0.51	−1.0	—	−0.42	—	mA
			V_{OH} = 2.5V	5	−2.50	—	−2.10	−4.0	—	−1.70	—	
			V_{OH} = 9.5V	10	−1.50	—	−1.30	−2.2	—	−1.10	—	
			V_{OH} = 13.5V	15	−4.00	—	−3.40	−9.0	—	−2.80	—	
			$V_{IN} = V_{SS}$, V_{DD}									
Output Low Current		I_{OL}	V_{OL} = 0.4V	5	0.61	—	0.51	1.5	—	0.42	—	
			V_{OL} = 0.5V	10	1.50	—	1.30	3.8	—	1.10	—	
			V_{OL} = 1.5V	15	4.00	—	3.40	15.0	—	2.80	—	
			$V_{IN} = V_{SS}$, V_{DD}									
Input High Voltage		V_{IH}	V_{OUT} = 0.5V, 4.5V	5	3.5	—	3.5	2.75	—	3.5	—	V
			V_{OUT} = 1.0V, 9.0V	10	7.0	—	7.0	5.50	—	7.0	—	
			V_{OUT} = 1.5V, 13.5V	15	11.0	—	11.0	8.25	—	11.0	—	
			$\|I_{OUT}\| < 1\mu A$									
Input Low Voltage		V_{IL}	V_{OUT} = 0.5V, 4.5V	5	—	1.5	—	2.25	1.5	—	1.5	
			V_{OUT} = 1.0V, 9.0V	10	—	3.0	—	4.50	3.0	—	3.0	
			V_{OUT} = 1.5V, 13.5V	15	—	4.0	—	6.75	4.0	—	4.0	
			$\|I_{OUT}\| < 1\mu A$									
Input Current	"H" Level	I_{IH}	V_{IH} = 18V	18	—	0.1	—	10^{-5}	0.1	—	1.0	μA
	"L" Level	I_{IL}	V_{IL} = 0V	18	—	−0.1	—	-10^{-5}	−0.1	—	−1.0	
Quiescent Supply Current		I_{DD}	$V_{IN} = V_{SS}$, V_{DD} *	5	—	5	—	0.005	5	—	150	μA
				10	—	10	—	0.010	10	—	300	
				15	—	15	—	0.015	20	—	600	

* All valid input combinations.

DYNAMIC ELECTRICAL CHARACTERISTICS (Ta = 25°C, Vss = 0V, C_L = 50pF)

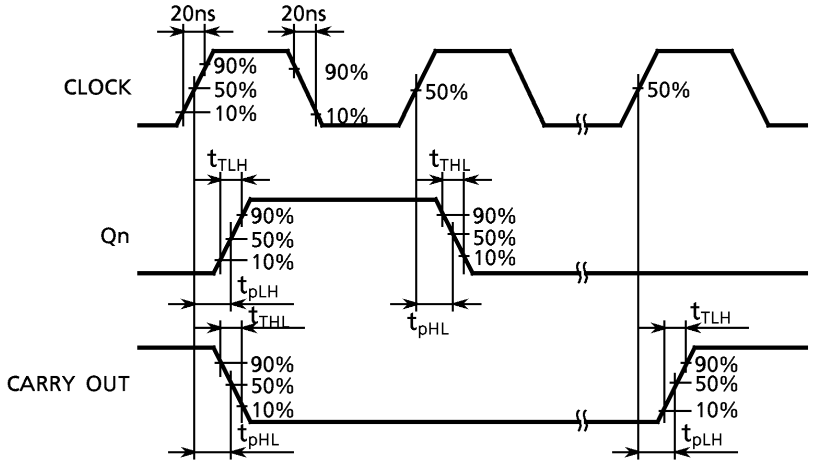
CHARACTERISTIC	SYMBOL	TEST CONDITION	V_{DD}(V)	MIN.	TYP.	MAX.	UNIT
Output Transition Time (Low to High)	t_{TLH}		5	—	80	200	ns
			10	—	50	100	
			15	—	40	80	
Output Transition Time (High to Low)	t_{THL}		5	—	80	200	
			10	—	50	100	
			15	—	40	80	

DYNAMIC ELECTRICAL CHARACTERISTICS (Ta = 25°C, Vss = 0V, C_L = 50pF)

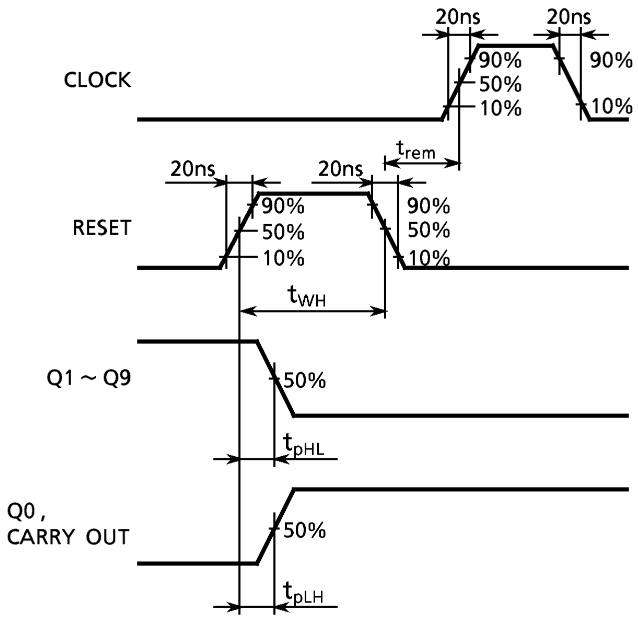
CHARACTERISTIC	SYMBOL	TEST CONDITION	V_{DD}(V)	MIN.	TYP.	MAX.	UNIT
Propagation Delay Time (CLOCK - Qn)	t_{pLH} t_{pHL}		5 10 15	— — —	325 135 85	650 270 170	ns
Propagation Delay Time (CLOCK - CARRY OUT)	t_{pLH} t_{pHL}		5 10 15	— — —	280 110 75	600 250 160	ns
Propagation Delay Time (RESET - Qn RESET - CARRY OUT)	t_{pLH} t_{pHL}		5 10 15	— — —	265 115 85	530 230 170	ns
Max. Clock Frequency	f_{CL}		5 10 15	2.5 5.0 6.7	6.0 12.0 13.5	— — —	MHz
Min. Clock Pulse Width	t_W		5 10 15	— — —	85 40 35	200 90 60	ns
Min. Pulse Width (RESET)	t_{WH}		5 10 15	— — —	50 20 15	260 110 60	ns
Max. Clock Rise Time Max. Clock Fall Time	t_{rCL} t_{fCL}		5 10 15	No Limit			μs
Min. Set-up Time (CLOCK INHIBIT - CLOCK)	t_{SU}		5 10 15	— — —	30 15 10	230 100 70	ns
Min. Removal Time (RESET - CLOCK)	t_{rem}		5 10 15	— — —	– 55 – 20 – 15	400 275 150	ns
Input Capacitance	C_{IN}			—	5	7.5	pF

WAVEFORMS FOR MEASUREMENT OF DYNAMIC CHARACTERISTICS

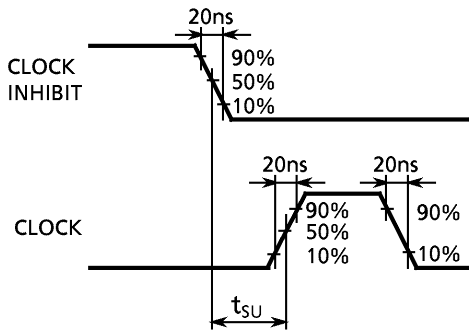
WAVEFORM 1.



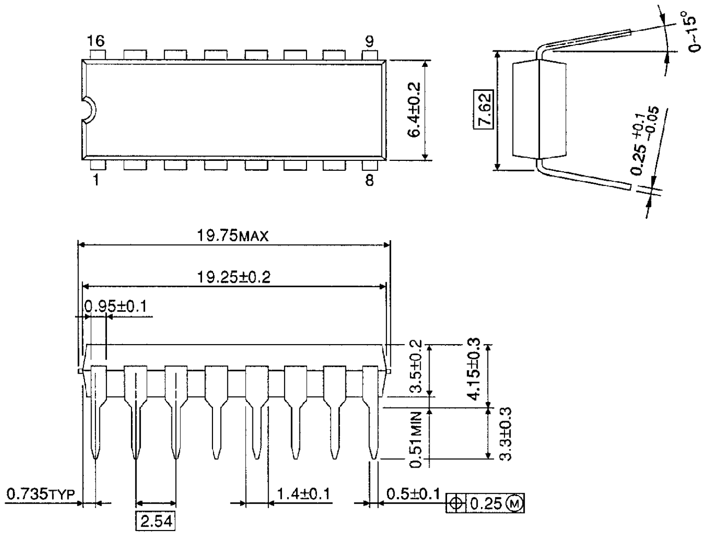
WAVEFORM 2.



WAVEFORM 3.

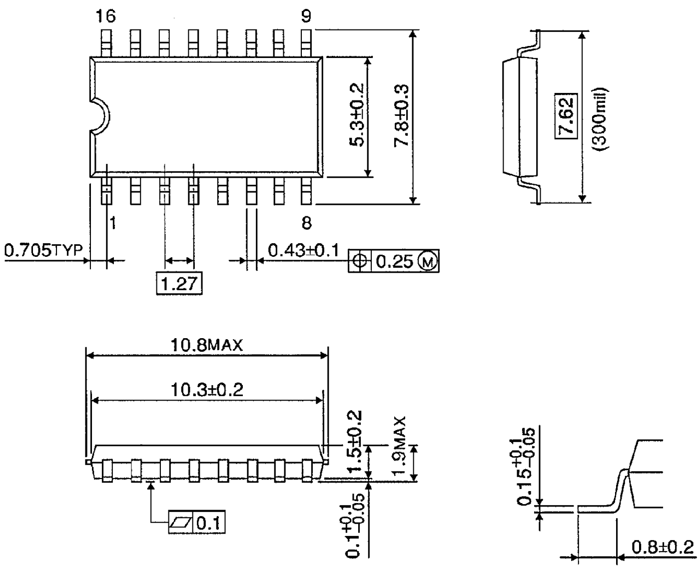


DIP 16PIN PACKAGE DIMENSIONS (DIP16-P-300-2.54A) Unit in mm



Weight : 1.00g (Typ.)

SOP 16PIN (200mil BODY) PACKAGE DIMENSIONS (SOP16-P-300-1.27) Unit in mm



Weight : 0.18g (Typ.)

RESTRICTIONS ON PRODUCT USE

000707EBA

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TOSHIBA BIPOLAR DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TD62501P,TD62501F,TD62502P,TD62502F,TD62503P,TD62503F,TD62504P TD62504F,TD62505P,TD62505F,TD62506P,TD62506F,TD62507P,TD62507F

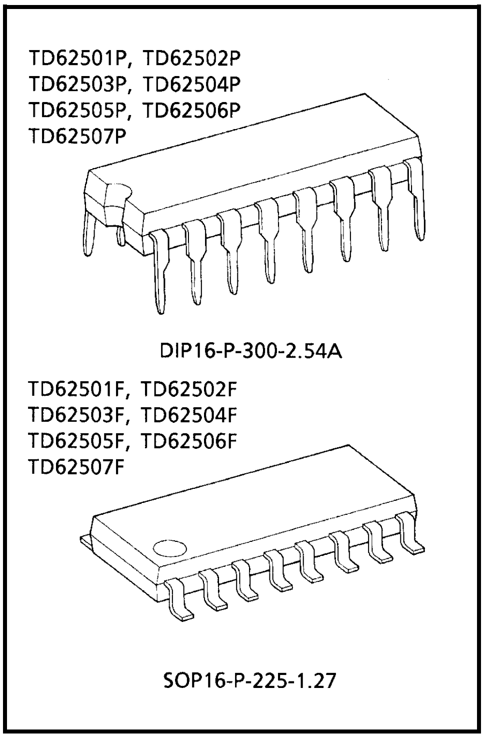
7CH SINGLE DRIVER

TD62501, 502, 503, 504P / F : COMMON EMITTER

TD62505, 506P / F : COMMON COLLECTOR

TD62507P / F : ISOLATED

The TD62501P / F Series are comprised of seven or five NPN Transistor Arrays.
For proper operation, the substrate (SUB) must be connected to the most negative voltage.
Applications include relay, hammer, Lamp and display (LED) drivers.



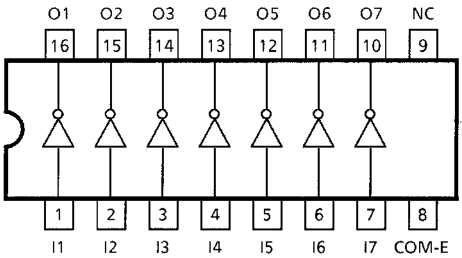
Weight
DIP16−P−300−2.54A : 1.11 g (Typ.)
SOP16−P−225−1.27 : 0.16 g (Typ.)

FEATURES

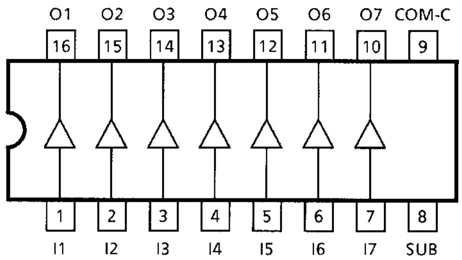
- Output Current (Single Output) 200 mA MAX.
- High Sustaining Voltage Output 35 V MIN.
- Inputs Compatible with Various Types of Logic.
- TD62501P / F, TD62505P / F and TD62507P / F: Using external resistor···General Purpose
- TD62502P / F
  : RIN = 10.5 kΩ + 7V Zener Diode···14~25 V P−MOS
- TD62503P / F, TD62506P / F
  : R_{IN} = 2.7 kΩ···TTL, 5 V C−MOS
- TD62504P / F, : R_{IN} = 10.5 kΩ···6~15 V P−MOS, C−MOS
- Package Type−P : DIP−16 pin
- Package Type−F : SOP−16 pin

PIN CONNECTION (Top view)

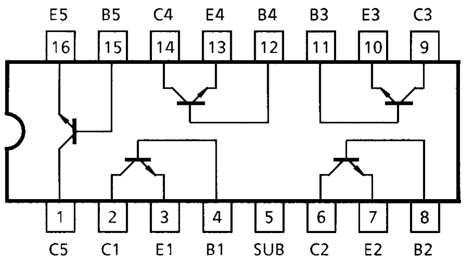
TD62501P / F, TD62502P / F
TD62503P / F, TD62504P / F



TD62505P / F, TD62506P / F

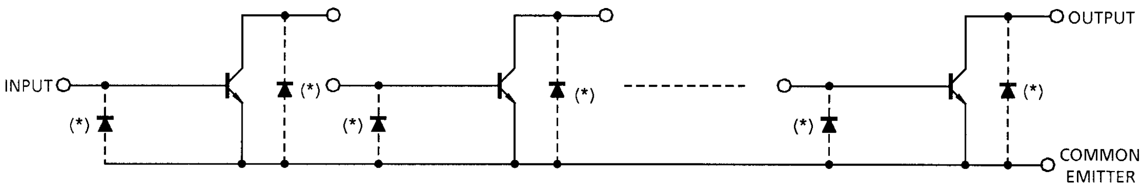


TD62507P / F

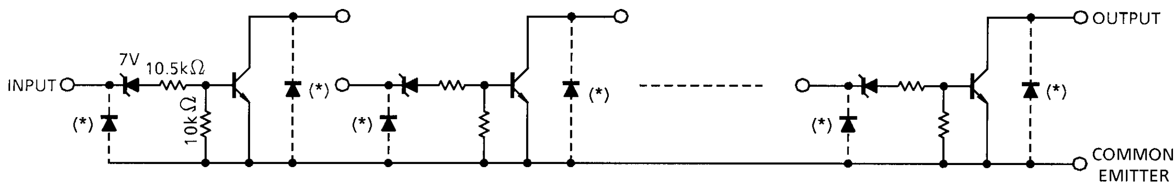


SCHEMATICS (Each driver)

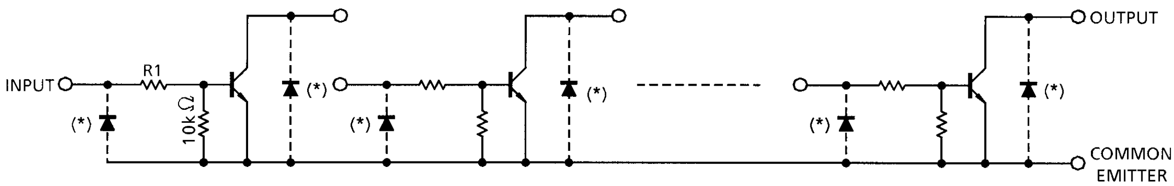
TD62501P / F



TD62502P / F



TD62503P / F
TD62504P / F

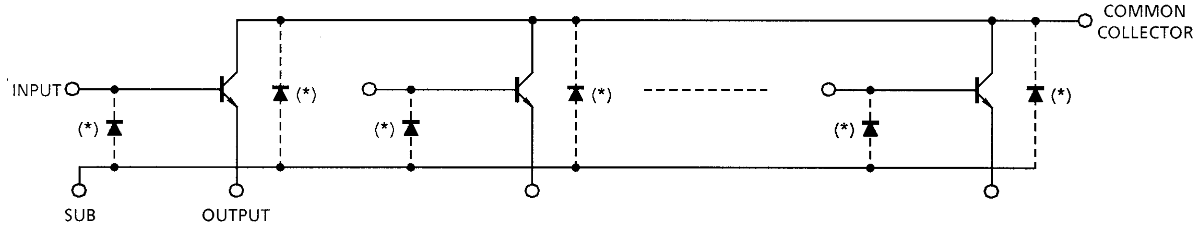


TD62503P / F R1 = 2.7 kΩ, TD62504P / F R1 = 10.5 kΩ

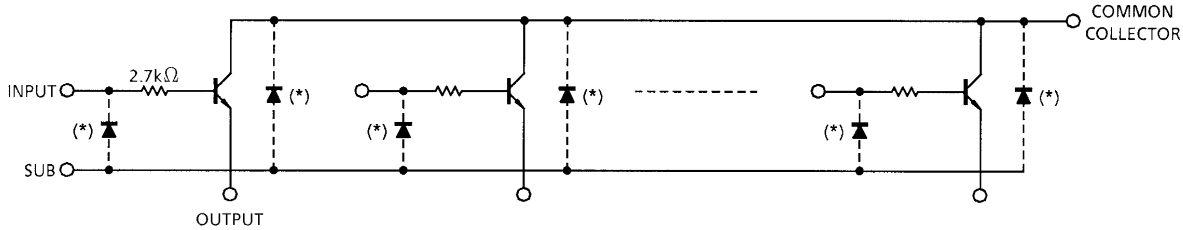
*: Parasitic Diodes

SCHEMATICS (Each driver)

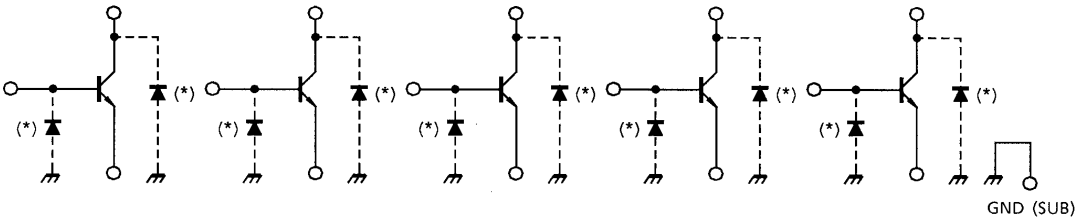
TD62505P / F



TD62506P / F



TD62507P / F



*: Parasitic Diodes
Note: The input and output parasitic diodes cannot be used as clamp diodes.

MAXIMUM RATINGS (Ta = 25°C Unless otherwise noted)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector−Emitter Voltage		V_{CEO}	35	V
Collector−Base Voltage		V_{CBO}	50	V
Collector Current		I_C	200	mA / ch
Input Voltage		V_{IN} (Note 1)	−0.5~45	V
		V_{IN} (Note 2)	−0.5~30	
Input Current		I_{IN} (Note 3)	25	mA
Isolation Voltage		V_{SUB}	35	V
Power Dissipation	P	P_D	1.0	W
	F		0.625 (Note 4)	
Operating Temperature		T_{opr}	−40~85	°C
Storage Temperature		T_{stg}	−55~150	°C

Note 1: TD62506P / F
Note 2: TD62502P / F, TD62503P / F, TD62504P / F
Note 3: TD62501P / F, TD62505P / F, TD62507P / F
Note 4: On Glass Epoxy PCB (30 × 30 × 1.6 mm, Cu 50%)

RECOMMENDED OPERATING CONDITIONS (Ta = −40~85°C)

CHARACTERISTIC		SYMBOL	CONDITION	MIN	TYP.	MAX	UNIT
Collector−Emitter Voltage		V_{CEO}		0	—	35	V
Collector−Base Voltage		V_{CBO}		0	—	50	V
Collector Current		I_C		0	—	150	mA / ch
Input Voltage	TD62506P / F	V_{IN}		0	—	35	V
	TD62502P / F TD62503P / F TD62504P / F			0	—	25	
Input Current	TD62501P / F TD62505P / F TD62507P / F	I_{IN}		0	—	10	mA
Power Dissipation	P	P_D		—	—	0.360	W
	F		On PCB (Note)	—	—	0.325	

Note: 30 × 30 × 1.6 mm, Cu 50%

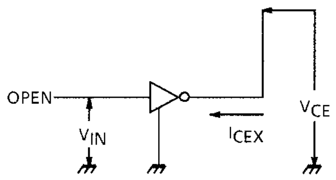
ELECTRICAL CHARACTERISTICS (Ta = 25°C Unless otherwise noted)

CHARACTERISTIC		SYMBOL	TEST CIR−CUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT
Output Leakage Current		I_{CEX}	1	V_{CE} = 25 V, V_{IN} = 0	—	—	10	μA
Collector−Emitter Saturation Voltage		$V_{CE\ (sat)}$	2	I_{IN} = 1 mA, I_C = 10 mA	—	—	0.2	V
				I_{IN} = 3 mA, I_C = 150 mA (Note 1)	—	—	0.8	
DCCurrent Transfer Ratio	(Note 2)	h_{FE}	2	V_{CE} = 10 V, I_C = 10 mA	70	—	—	
	(Note 3)				50	—	—	
Input Voltage	TD62502P / F	$V_{IN\ (ON)}$	3	I_{IN} = 1 mA I_C = 10 mA	13	17	23	V
	TD62503P / F				2.4	3.4	4.2	
	TD62504P / F				7.5	11.5	15	
Turn−On Delay		t_{ON}	4	V_{OUT} = 35 V, R_L = 3.3 kΩ C_L = 15 pF	—	50	—	ns
Turn−Off Delay		t_{OFF}			—	200	—	

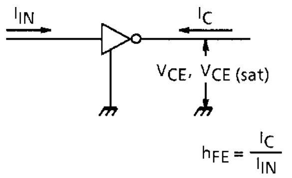
Note 1: Except TD62502P / F Only
Note 2: Only TD62501P / F, TD62505P / F, TD62506P / F, TD62507P / F
Note 3: Only TD62502P / F, TD62503P / F, TD62504P / F

TEST CIRCUIT

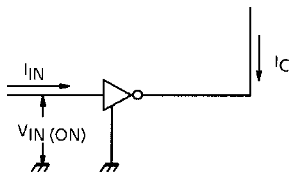
1. I_{CEX}



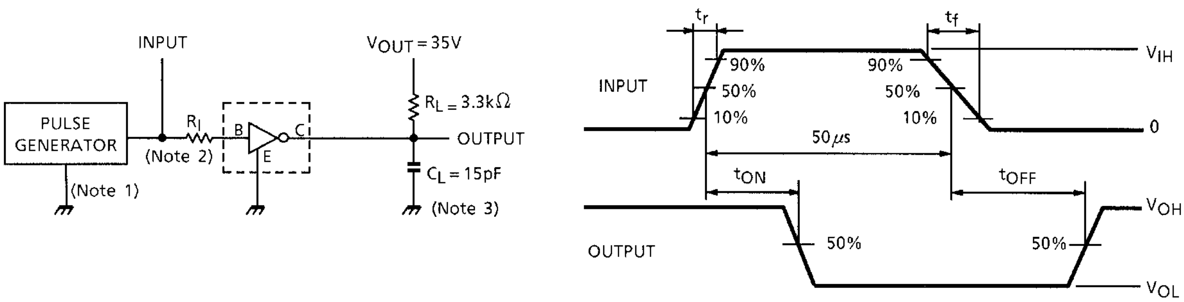
2. h_{FE}, $V_{CE\ (sat)}$



3. $V_{IN\ (ON)}$



4. t_{ON}, t_{OFF}



Note 1: Pulse Width 50 μs, Duty Cycle 10%
Output Impedance 50 Ω, t_r ≤ 5 ns, t_f ≤ 10 ns
Note 2: See below

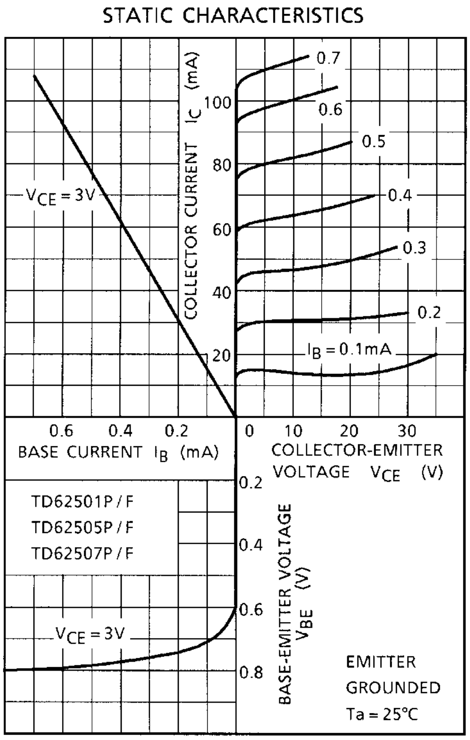
INPUT CONDITION

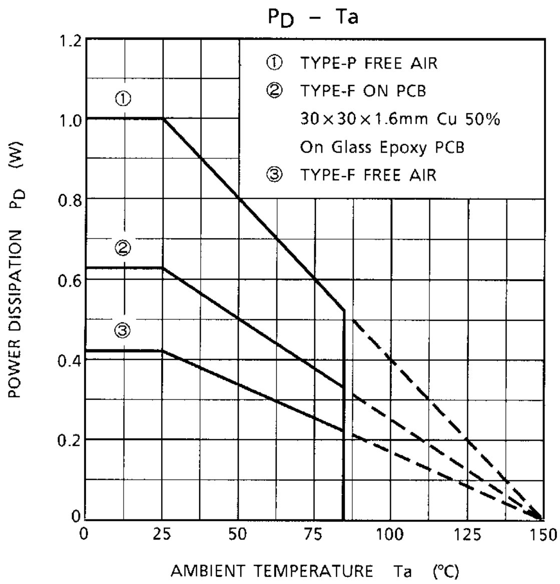
TYPE NUMBER	R_I	V_{IH}
TD62501P / F	2.7 kΩ	3 V
TD62502P / F	0 Ω	15 V
TD62503P / F	0 Ω	3 V
TD62504P / F	0 Ω	10 V
TD62505P / F	2.7 kΩ	3 V
TD62506P / F	0 Ω	3 V
TD62507P / F	2.7 kΩ	3 V

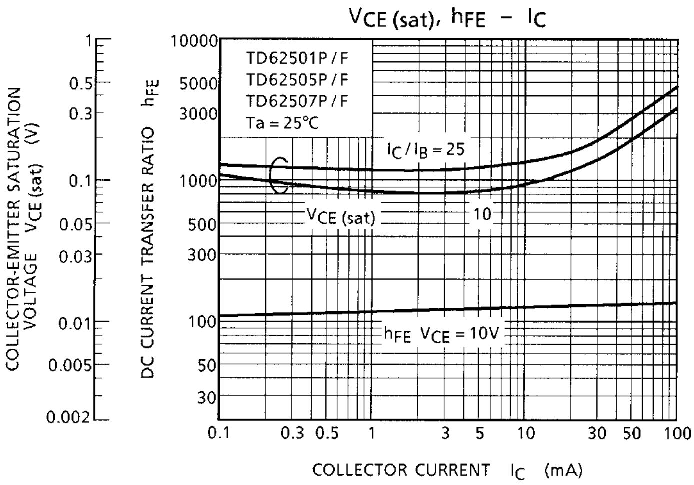
Note 3: C_L includes probe and jig capacitance

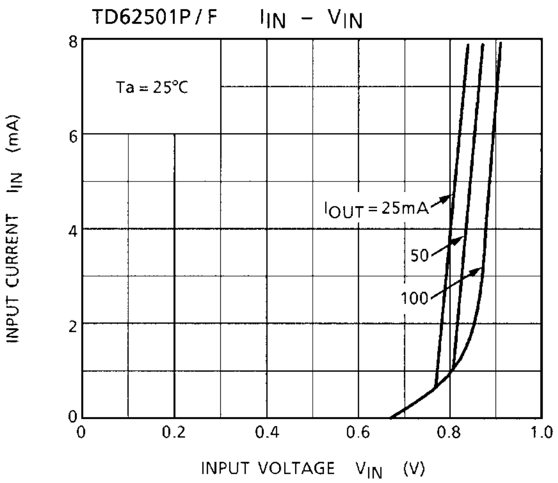
PRECAUTIONS for USING

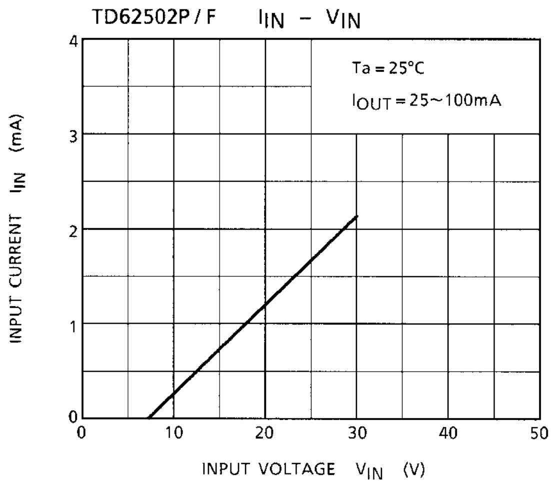
This IC does not integrate protection circuits such as overcurrent and overvoltage protectors.
Thus, if excess current or voltage is applied to the IC, the IC may be damaged. Please design the IC so that excess current or voltage will not be applied to the IC.
Utmost care is necessary in the design of the output line, V_{CC} and GND line since IC may be destroyed due to short−circuit between outputs, air contamination fault, or fault by improper grounding.

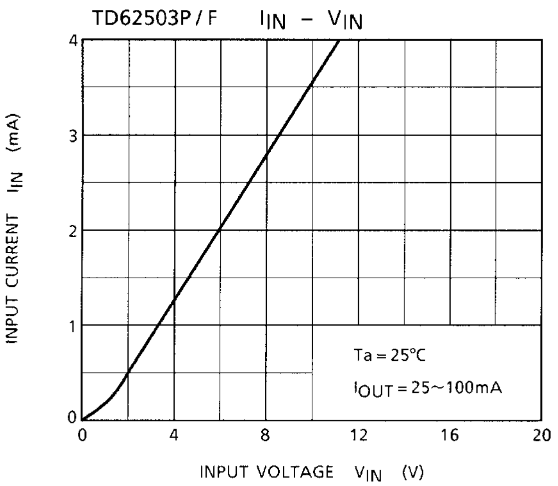

STATIC CHARACTERISTICS
COLLECTOR CURRENT IC (mA)
VCE = 3V
0.7
0.6
0.5
0.4
0.3
0.2
IB = 0.1mA
BASE CURRENT IB (mA)
COLLECTOR-EMITTER VOLTAGE VCE (V)
TD62501P / F
TD62505P / F
TD62507P / F
BASE-EMITTER VOLTAGE VBE (V)
EMITTER GROUNDED
Ta = 25°C

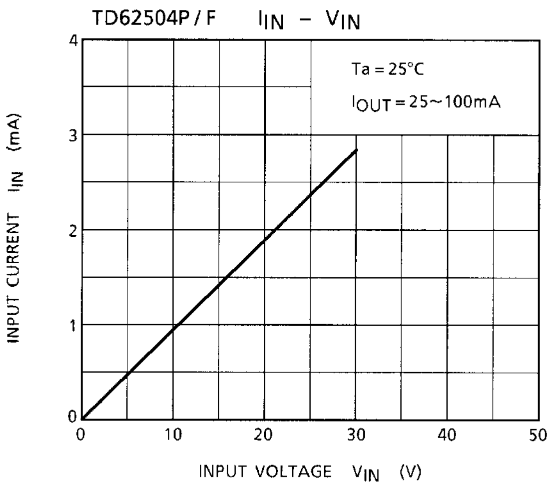

PD – Ta
① TYPE-P FREE AIR
② TYPE-F ON PCB
30 × 30 × 1.6mm Cu 50%
On Glass Epoxy PCB
③ TYPE-F FREE AIR
POWER DISSIPATION PD (W)
AMBIENT TEMPERATURE Ta (°C)

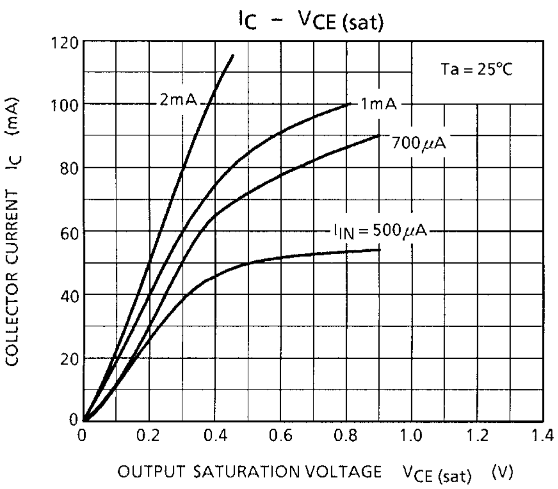

VCE (sat), hFE – IC
TD62501P / F
TD62505P / F
TD62507P / F
Ta = 25°C
IC / IB = 25
10
VCE (sat)
hFE VCE = 10V
COLLECTOR-EMITTER SATURATION VOLTAGE VCE (sat) (V)
DC CURRENT TRANSFER RATIO hFE
COLLECTOR CURRENT IC (mA)


TD62501P / F IIN – VIN
Ta = 25°C
IOUT = 25mA
50
100
INPUT CURRENT IIN (mA)
INPUT VOLTAGE VIN (V)
0
2
4
6
8
0.2
0.4
0.6
0.8
1.0


TD62502P / F IIN – VIN
Ta = 25°C
IOUT = 25~100mA
INPUT CURRENT IIN (mA)
INPUT VOLTAGE VIN (V)
0
1
2
3
4
10
20
30
40
50

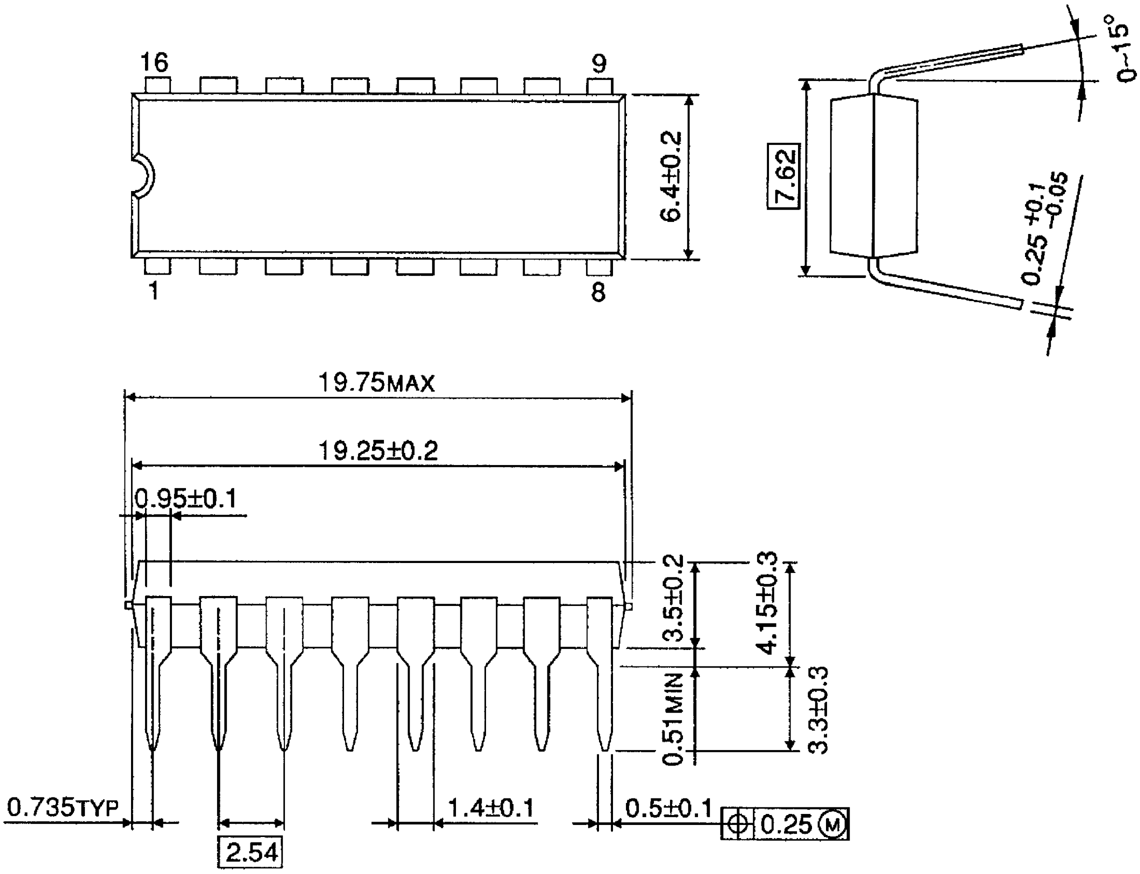

TD62503P / F IIN – VIN
Ta = 25°C
IOUT = 25~100mA
INPUT CURRENT IIN (mA)
INPUT VOLTAGE VIN (V)
0
1
2
3
4
8
12
16
20


TD62504P / F IIN – VIN
Ta = 25°C
IOUT = 25~100mA
INPUT CURRENT IIN (mA)
INPUT VOLTAGE VIN (V)
0
1
2
3
4
10
20
30
40
50


IC – VCE (sat)
Ta = 25°C
2mA
1mA
700μA
IIN = 500μA
COLLECTOR CURRENT IC (mA)
OUTPUT SATURATION VOLTAGE VCE (sat) (V)
0
20
40
60
80
100
120
0.2
0.4
0.6
0.8
1.0
1.2
1.4

PACKAGE DIMENSIONS

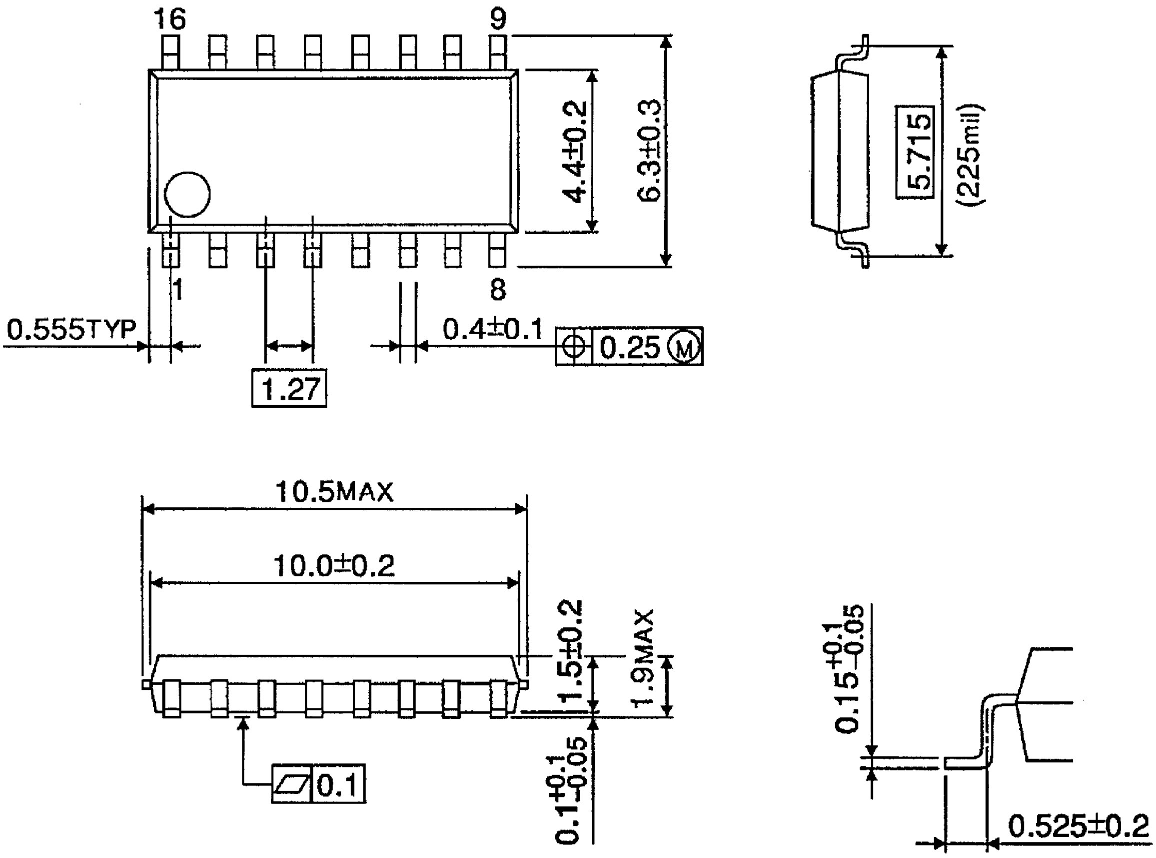
DIP16−P−300−2.54A Unit: mm



Weight: 1.11 g (Typ.)

PACKAGE DIMENSIONS

SOP16−P−225−1.27 Unit: mm



Weight: 0.16 g (Typ.)

RESTRICTIONS ON PRODUCT USE

000707EBA

μPC575C2

2.0W音声電力増幅回路／2.0WAF Power Amplifier

特　徴

μPC575C2 は，電源電圧13.2V，8Ωスピーカを標準とした出力電力2.0W の高利得，低雑音の音声電力増幅用半導体集積回路です。

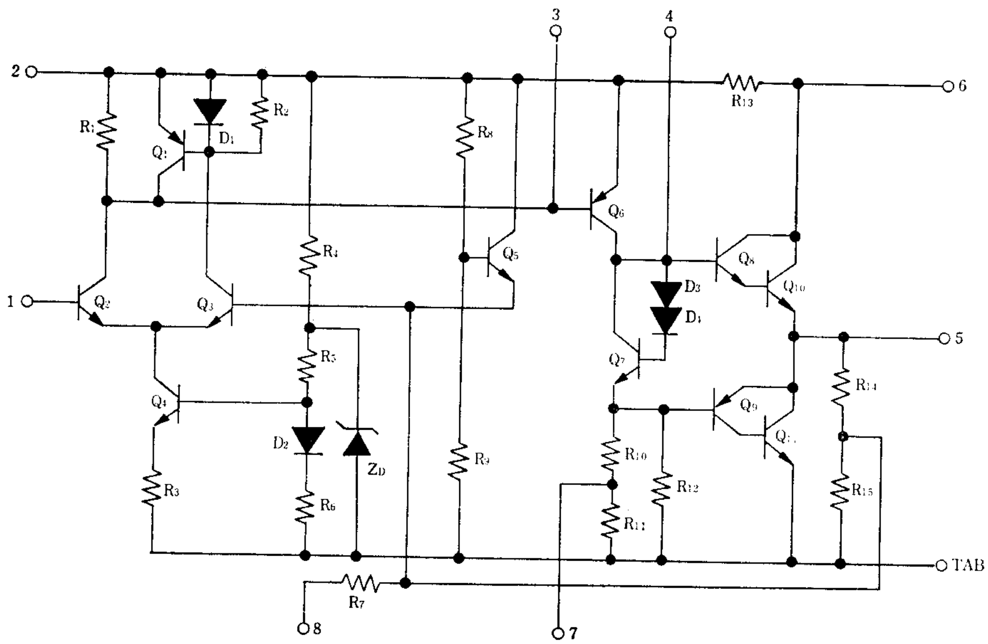
カーラジオ，小型ステレオ・プレーヤーなどの音声電力増幅用として最適です。

外形は実装作業性のよい，8ピンTAB 付プラスチック DIP です。

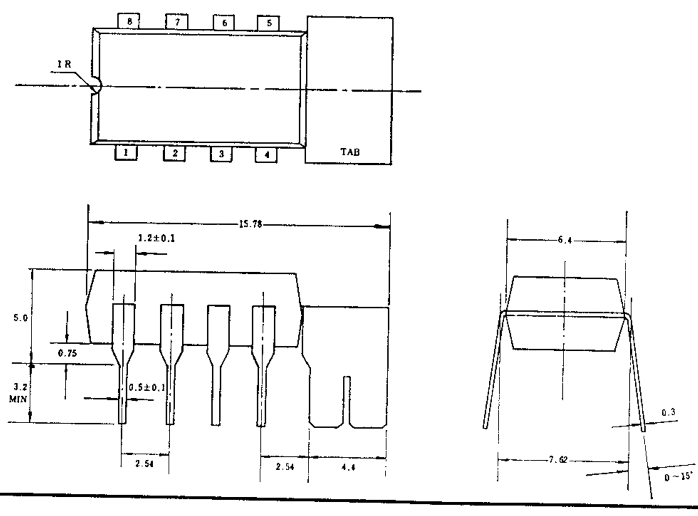
Feature

The μPC575C2 is an integrated circuit designed for high power and low noise audio power amplifier (2.0W at 8Ω 13.2V) applications, and suitable for use in car radio sets and small stereo sets. The μPC575C2 is encapsulated in 8 pin Dual In-Line Plastic package with tab.

等価回路／Equivalent Circuit



外形図／Package Dimensions(Unit:mm)



⇨ 応用例は 940, 951 ページをご参照下さい。

絶対最大定格／Absolute Maximum Ratings (T_a=25°C)

項　目	略　号	定　格	単　位
電源電圧（無信号時）	V_{CC1}	20	V
電源電圧（動作時）	V_{CC2}	17	V
回路電流	$I_{CC(peak)}$	1	A
パッケージ許容損失	P_D *	1.9	W
動作温度範囲	T_{opt}	−20～+ 75	°C
保存温度範囲	T_{stg}	−40～+150	°C

* プリント銅箔基板30mm×30mm 使用

電気的特性／Electrical Characteristics (T_a=25°C, V_{CC}=13.2V, f=1kHz, R_L=8Ω)

項　目	略　号	条　件	MIN.	TYP.	MAX.	単 位
回路電流	I_{CC}	V_I=0	8	12	16	mA
出力電力	P_O	T.H.D.=10%	1.5	2.0		W
ひずみ率	T.H.D.	P_O=0.5W		0.5	1.5	%
電圧利得	A_v	P_O=0.5W	51	*	56	dB
雑音出力	v_n	R_G=0Ω		0.4	0.8	mV

* 電圧利得 A_v については 3dB 幅で分類可能です。

測定回路／Test Circuit